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No. 66

THE CLIMATE OF ABERDEEN

by J. A. Plant

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October 1970

FOREWORD

The Meteorological Office at 26, Palmerston Place, Edinburgh, EH12 5AN and the Glasgow Weather Centre at 118, Waterloo Street, Glasgow, G2 receive an ever increasing number of requests from all sections of the community, especially from members of the building and construction industries, for information about the past weather at places in Scotland.

It is not yet possible to issue precise long range weather forecasts and one can only plan or design well ahead on the basis of past experience i.e. by consulting recorded facts and statistics of past weather of the type contained in this Report, but from these, one can at least set limits and assess the probabilities.

This Report on Aberdeen's climate is similar in general content to the previously published Meteorological Office Reports on Edinburgh, Glasgow, the Coastal Region of the Moray Firth and West Lothian and includes certain data which will be of particular interest at the tendering or design stages of a building contract in Aberdeen. For example, building contractors will be interested in the figures showing the probable amount of working time during which outdoor work may be hampered or have to cease because of rainfall, low temperatures and high winds. Similarly, engineers concerned with the design and efficiency of heating and air conditioning installations will wish to consult the detailed statistics of temperature and relative humidity. Advice is also given on maximum wind speeds for the calculation of wind loadings on buildings, glass specifications etc. Statistics of rainfall amounts and intensities have been included for the guidance of drainage engineers concerned with the design of sewers and culverts etc. and there are many other facts and figures which will be of interest to architects and engineers.

It is hoped that the information contained in this Report will also be of interest to students and the general reader.

August 1970

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THE CLIMATE OF ABERDEEN

by J A Plant

Aberdeen lies on the North Sea coast of Scotland between the mouths of the rivers Dee and Don but also includes the north facing slopes of the high ground to the south of the Dee where there is considerable industrial development. The city is ringed on its western side by the foothills of the Grampians which stretch through the sector between south-south-west through west to north-west, while to the north-west and north lies the Buchan platform, an open expanse of rolling country with few trees, reaching to the coastline of the Moray Firth. Thus, Aberdeen is open to the relatively cold waters of the North Sea to the north, east and south and it is generally true to say that the most unpleasant aspects of the local climate are all associated with winds which have had a track over the North Sea before reaching the city.

For example, during the winter and spring months, fresh easterly or northerly winds on days with high relative humidities and low air temperatures bring a touch of rawness to the climate and in the spring and summer, haar (North Sea fog) provides visible evidence of the onset of high relative humidity. Unlike most of Britain, Aberdeen receives the major part of its rainfall from easterly winds and in spring and early summer when these winds have had a long track over the North Sea, the resulting rains are cold rains. However, the proximity of the North Sea does benefit Aberdeen in one important respect in that the sea surface temperature in winter remains relatively high when compared with the ground surface temperature over the adjacent coastal areas of Northern Europe and because of this moderating influence, winter temperatures in Aberdeen are comparable with those of London and other places much further to the south. Also on the credit side is the fact that the duration of sunshine in Aberdeen is high in relation to the latitude and the rainfall is well below the average for Scotland and the United Kingdom as a whole.

A special mention should be made of the clear warm air sometimes experienced in the Aberdeen area when moist south-west to west winds pass over the high ground of southern and central Scotland, giving rise to the föhn effect. Not only do these winds deposit most of their moisture over the high ground before reaching Aberdeen but in their descent on the leeward side, the air is warmed and there is a reduction in relative humidity; the associated cloud sheets dissipate and may clear completely with consequent further warming by insolation. In the most favourable circumstances for föhn development, usually in the autumn and winter, temperatures in the Aberdeen area can be the highest recorded in the British Isles. These outstanding occurrences are very transient and rather exceptional but nevertheless, the föhn effect in varying degrees is often present and there is no doubt that it does bring to the coastal region, drier and sometimes sunnier weather with lower humidities than would otherwise prevail.

The topography of Aberdeen and its environs is extremely varied and although the visitor may not gain the impression of a hilly city, nevertheless the ground rises quite rapidly in the western outskirts. For example the ridge which has its highest points in Brimond Hill (870 feet) and Tyrebagger Hill (821 feet) lies only about 6 to 7 miles north-west of the city centre and there are several knolls near the western boundary reaching an altitude of 500 to 600 feet.

Perhaps the best general picture of the terrain in the main built-up area of the city is obtained by visualising an east-facing slope cut across by the valley of the Don in the north and the Dee in the south and fretted by numerous small valleys or defiles running mainly downhill in a seawards direction.

The separate aspects of the climate of Aberdeen are discussed in more detail in the following paragraphs under the headings of Rainfall, Temperature and Relative Humidity, Sunshine, Winds, Fog, Snow and Thunderstorms.

1. RAINFALL

As mentioned previously, Aberdeen, and north-east Scotland in general, do not receive the major part of their rainfall from the warm humid south-west to west winds from the Atlantic since these winds deposit most of their moisture over the mountain barriers to the west and south-west. However, when Atlantic depression systems are approaching or crossing the Scottish mainland, they frequently give a period of winds from between east and south, and it is these winds which bring the heavier and continuous rains. Stationary or slow-moving depressions which move into or over the North Sea from the west have a similar effect, although on these occasions the winds are backed more towards north-east. Considerable precipitation is also associated with winds from between north-west and north-east which frequently bring showery weather. In winter, the showers are often heavy and prolonged and in suitable conditions, bring heavy snowfall. However, in fairness to Aberdeen, perhaps it should be emphasised that the city is dry by Scottish standards and the rainfall is considerably less than that which falls to the west and south-west.

It can be seen from the rainfall map at Figure 1 that most of the built-up area of Aberdeen has an annual average rainfall of about 30 inches. This is very similar to the average rainfall in Dundee, Perth and the higher southern suburbs of Edinburgh and only a little more than the London area. It is appreciably less than in Glasgow which has an annual average of 40 inches. The association of increased rainfall with altitude will be noted from Figure 1 with the average rainfall increasing to over 35 inches over the higher ground a short distance inland from the coast.

Monthly and Annual Rainfall Averages for a number of rainfall measuring stations in the Aberdeen area are given in Tables 1 and 1A. The monthly averages serve as a useful pointer to the rainfall cycle throughout the year with a dry spring and early summer often giving way to a wetter July but followed by drier spells in August and September before the onset of the rains of late autumn and winter.

Cumulative Averages of Daily Rainfall for Mannofield Reservoir, Aberdeen, from which the average rainfall over any particular part of the year can be calculated are given in Table 1B. Mannofield Reservoir is the oldest established rainfall measuring station in the Aberdeen area.

Statistics of Monthly and Annual Rainfalls for Mannofield Reservoir are given in Table 1C.

Cumulative Frequencies of Daily Rainfall for Mannofield Reservoir which show the total number of days in 50 years with specified amounts of rain (i.e. the number of days in 50 years with 0.5 inches or more, 1 inch or more, 2 inches or more etc.) are given in Table 1D.

Maximum Daily Rainfalls recorded at Mannofield Reservoir are given in Table 1E.

Wettest Months. The daily falls recorded at Mannofield Reservoir in December 1929, October 1932, July 1940, November 1940, November 1946, November 1951, July 1957 and October 1960 are given in Table 1F. These months, which all had more than 7 inches of rain, were the eight wettest months at Mannofield Reservoir during the 56 years from 1913 to 1968.

Duration of Rainfall. The total monthly durations of rainfall recorded at Dyce Airport during the 20 years from 1949 to 1968 are given in Table 1G. It can be seen from this Table that in the Aberdeen area, rain falls in measurable amounts for about 630 hours per year, that is about one hour in fourteen. Over nearly all south-east England rain falls in measurable amounts for about 500 hours in the year, that is about one hour in seventeen.

Intense Falls of Rain in Short Periods of Time. Examination of rainfall records reveals that the intensity is always changing and that within any period of rain, a shorter period will always be found where the intensity is greater than that of the whole. Usually, the most intense falls of short duration are associated with thunderstorms or thundery activity. Aberdeen does experience intense falls of rain of short duration but

since the frequency of thunderstorms in Aberdeen is less than in the upland parts of Scotland and the more thundery areas in central and south-west Scotland, it is reasonable to suppose that the probability of an intense fall of rain in a short period of time is less in Aberdeen than in these more thundery areas. Similarly, when compared with Aberdeen, parts of central and southern England have two or three times as many thunderstorms and therefore the probability of an intense fall of rain of short duration in Aberdeen is much less than in the south.

Table 1H gives the number of days in each year from 1946 to 1968 with specified amounts of rain falling in specified times at the Meteorological Office at Dyce (Aberdeen) Airport. The total number of days over the whole period of 23 years is shown at the foot of the Table. Dyce Airport is the only location in the Aberdeen area for which statistics of this type are available for a reasonably long period of years, but, unfortunately, a period of 23 years of recorded rainfall intensities is too short a term from which to obtain a reliable assessment of the long-term relationship between intensity and frequency at any individual recording station.

There are very few long-period records of rainfall intensities for places in Scotland and therefore drainage engineers make fairly wide use of the Bilham formula (1) for obtaining probabilities of intense falls of rain in short periods of time. Following a recent investigation by D J Holland (2) it has become necessary to modify the frequencies obtained from Bilham's formula in respect of intensities greater than 1.25 inches per hour and the figures given in the upper table of Table II, which refer to falls with durations of 2 hours or less, are based on Bilham's formula modified where necessary by Holland. However, it can be seen from Table 1J, which compares the observed frequencies obtained from the Dyce Airport records, that for durations up to about 2 hours, the frequencies obtained from the modified Bilham formula appear to be too high when related to Aberdeen. The falls of 0.6 inches within 15 minutes or less

and 0.8 inches falling within 30 minutes or less shown in Table 1H were both recorded during two unusually intense downpours on 18 June 1946 and 1 August 1948 and it is interesting to note that similar falls did not occur again during the following 20 years. Indeed, it is considered that to have two recorded falls of this magnitude and duration in the Aberdeen area during a period as short as 23 years is a "statistical accident". Moreover, it should be noted that it is these two falls which account for the two values in Column 'C' of Table 1J which are out of keeping with the others, viz. 100% for 0.6 inches in 15 minutes or less and 113% for 0.8 inches in 30 minutes or less.

Experience suggests that for durations up to about 2 hours, the frequencies obtained from the modified Bilham formula could be halved when applied to Aberdeen i.e. a return period of "1 day per 5 years" obtained from the upper table of Table 1I would become "1 day per 10 years". Alternatively, for durations up to 2 hours, a 20 per cent reduction could be made to the amounts quoted in the upper table of Table 1I to relate the intensities calculated from the modified Bilham formula to the Aberdeen area.

When studying the comparison of the observed and estimated frequencies given in Table 1J, perhaps it is equally important to note that for durations of 4 to 8 hours or more, the estimated frequencies obtained from the modified Bilham formula are lower in most cases than the actual frequencies observed at Dyce Airport.

So far, the data discussed refer to rainfall at a point, but areal rainfall is required for most design purposes. Because of the variability of intense rain in space and time, the areal rainfall for a given duration and return period is in general smaller than the corresponding point rainfall. To obtain areal rainfall, the point rainfall should be multiplied by the appropriate factor in the lower table of Table 1I. These factors were derived from a formula by D J Holland, assuming a roughly circular area and a roughly equal contribution to the drainage system from all parts of the area. Advice on how to apply these factors to the more difficult cases can usually be given by the

Meteorological Office or the Road Research Laboratory of the Ministry of Transport. The formula is based on results from an experimental raingauge network at Cardington near Bedford (3). A similar experiment in rather more hilly country near Winchcombe in the Cotswolds is still being analysed.

Rain as a factor interrupting outdoor work in Aberdeen

Tables 1K to 1M give frequencies of rain falling in the working part of the day which may be helpful in assessing the probable amount of time during which rainfall may hamper or interrupt outdoor building work in the Aberdeen area. These Tables have been prepared from hourly measurements of rainfall recorded at Dyce Airport during the 10 years from 1959 to 1968.

Builders will need no reminding of the many complex factors which need to be taken into account in trying to assess the probable amount of working time which might be lost because of inclement weather, particularly the time lost because of rainfall. Many of the factors involved are not entirely "meteorological", e.g. a heavy downpour of rain at the excavation stage could have very serious consequences and similarly, a fall of rain wetting the ground of a building site could preclude the use of heavy vehicles and earth-moving operations. Then there are the questions whether protective clothing is to be issued, whether the men can be transferred to work at another site, whether the men are to be paid a bonus or not, the tenacity of the foreman etc.

The meteorological factors involved are probably equally complex, but experience suggests that as far as rainfall is concerned, building contractors' main interest lies in the number of working days and working hours with (a) rainfall equal to or exceeding 0.1 millimetres per hour and (b) rainfall equal to or exceeding 0.5 millimetres per hour.

As intensities of rainfall are critical to the problem, this would seem to be an appropriate point at which to quote the Meteorological Office classifications of "slight", "moderate" and "heavy" rainfall. The following classifications have been taken from the Meteorological Office Observer's Handbook (HMSO):

- (a) Slight Rain is rain of low intensity, that is to say the rate of accumulation on the ground or in a raingauge is slow, not more than about 0.5 millimetres (0.02 inches) per hour. Such rain may consist of scattered large drops or more numerous small drops.
- (b) Moderate Rain is rain falling fast enough to form puddles rapidly and to accumulate in a raingauge at a rate between about 0.5 and 4.0 millimetres (0.02 to 0.16 inches) per hour.
- (c) Heavy Rain is a downpour which makes a roaring noise on roofs, forms a misty spray of fine droplets by splashing on road surfaces etc. and accumulates in a raingauge at a rate of more than about 4 millimetres (0.16 inches) per hour. The term includes not only the torrential rain of thunderstorms but also the heavier falls occurring without thunder.

Table 1K gives the total number of days per month during the 10 years from 1959 to 1968 on which 0.1 millimetres or more of rain fell during the working part of the day, i.e. between 0700 and 1700 hours Greenwich Mean Time (0800 and 1800 hours British Standard Time). Similarly, Table 1K also gives for the same ten year period, the total number of hours per month between 0700 and 1700 hours GMT with a total of 0.1 millimetres or more of rain falling within the hour. Days and hours with only a few spots of rain amounting to less than .05 millimetres have not been included in Table 1K but otherwise the reader will realise from what has already been said that days and hours with rain of 0.1 millimetres or more include all occasions of "slight", "moderate" and "heavy" rain. However, it should be borne in mind that amounts of the order of 0.1 millimetres are very small amounts of rain and that the totals in Table 1K therefore include many working days and many working hours with very slight rain, i.e. rain so slight that most types of outdoor work would not be affected.

It is, of course, extremely difficult to decide on a critical rate of rainfall above which outdoor work would be seriously hampered or have to cease,

because, as stated previously, this will depend to a great extent on the type of work, whether the building site is an exposed place and other factors. There is practically no experimental evidence on this subject, but in consultation with the Building Research Station, Ministry of Public Building and Works, it has been decided that the lower limit of precipitation (rain, drizzle, snow etc.) contributing to time lost in the building industry should be set at a rate of 0.5 millimetres or more per hour. The reader will notice that this critical rate of 0.5 millimetres or more per hour corresponds to the lower limit of the Meteorological Office classification of 'moderate' rainfall i.e. rain falling fast enough to form puddles rapidly. Thus, occasions with rain falling at a rate of 0.5 millimetres or more per hour can be thought of more simply as occasions with 'moderate' or 'heavy' rain.

Table 1L gives the total duration in hours and tenths of rain falling at a rate of 0.5 mm/hr or more (i.e. the total duration of 'moderate' or 'heavy' rain) between the hours of 0700 and 1700 GMT during the 10 years from 1959 to 1968. The monthly totals quoted in Table 1L have been obtained by adding up the duration of rain falling at a rate of 0.5 mm/hr or more in each hour between 0700 and 1700 hours on each day of the month. For example, rain falling at a rate of 0.5 mm/hr or more for 18 minutes during one hour would contribute a value of 0.3 hours to the total duration. Perhaps it should be emphasised at this point that the actual amount of working time lost in a day with rain will seldom keep in step with the duration of moderate or heavy rain on that day. For example, if moderate or heavy rain fell continuously for a period of, say, 30 minutes during part of the working day, the working time lost from the cessation to the resumption of work would almost certainly be considerably more than 30 minutes. It should also be borne in mind that, more often than not, a period of 'moderate' or 'heavy' rain is preceded or followed by a period of 'slight' rain. Consider, for instance, a single working day of ten hours between 0700 and 1700 GMT with intermittent rain, most of it quite slight but

increasing to the critical rate of 0.5 mm/hr (i.e. becoming moderate or heavy) for a period of, say, 12 minutes in each of the ten hours. The total duration of rain falling at a rate of 0.5 mm/hr throughout the whole ten hour period would be 10 times 12 minutes (or 10 times 0.2 hours) = 2 hours, whereas the actual amount of working time lost on this particular day might well be the whole period of ten hours.

Thus, it should be realised, that in the majority of cases, the duration figures quoted in Table 1L underestimate, perhaps grossly underestimate, the probable amount of time which would be lost on outdoor work in Aberdeen. However, the duration figures in Table 1L are useful in that they serve as an indication of the extreme lower limit of the working time likely to be lost because of rain.

A more satisfactory alternative to the figures in Table 1L showing the durations of moderate or heavy rain are figures showing the number of hours during which moderate or heavy rain fell for some time during the hour.

Table 1M provides this type of information and comprises the total number of days per month over the 10 years from 1959 to 1968 on which moderate or heavy rain fell at some time during the working day from 0700 to 1700 hours Greenwich Mean Time. Similarly, this Table also gives the total number of "hours" per month between 0700 and 1700 hours GMT in which moderate or heavy rain fell at some time during the hour. The figures in Table 1M will tend to overestimate the actual time lost on outdoor work because of rain, although the reader will appreciate from what has been said earlier that these figures will undoubtedly provide a safer and perhaps more realistic guide for planning purposes than the figures giving the actual durations of moderate or heavy rain.

Polythene shelters to cover the building site, or part of the site, obviate loss of working time due to inclement weather, and a study of the data in Table 1K to 1M, with a possible interpolation between the three sets of figures, may help building contractors to decide for particular jobs whether

it is an economic proposition to use these shelters. On the other hand, perhaps it should be stressed that while the figures in Tables 1K to 1M provide a guide to the duration of rainfall during the working part of the day, the figures do not provide a guide to the duration of the effects of the rain. For example, a localised heavy downpour of rain of short duration in Aberdeen could flood a building site (especially at the excavation stage) bringing work to a standstill for several days, but such a downpour might only contribute a value of say one or two extra hours with moderate or heavy rain. Clearly, a heavy downpour of rain falling outside the ten hour period from 0700 to 1700 hours could bring about a similar stoppage.

When consulting Tables 1K to 1M it should be borne in mind that the figures relate to a 7-day working week and not to a 5-day working week.

A table for converting amounts of rainfall in millimetres into amounts in inches is given at Table 1N.

Evaporation

Three percolation gauges, each one thousandth of an acre in area and containing 40 inches depth of soil, and each subject to different fertilizer treatment, were in operation at Craibstone (altitude 300 feet) near Aberdeen during the years from 1921 to 1946. Monthly estimates of calculated evaporation (defined as the rainfall during the month less percolation in the same period) and the annual totals are given in the appropriate issues of "British Rainfall". The mean annual values of calculated evaporation for the period 1921 to 1946 for the three gauges are:

Gauge No. 1	- unmanured	- 17.00 inches
Gauge No. 2	- manured	- 17.48 inches
Gauge No. 3	- manured and limed	- 18.34 inches

Estimated average values of potential transpiration (i.e. the water loss from an established turf surface assuming that the roots never run short of water) are given below for the coastal strip of Aberdeenshire within 5 miles

(approximately) of the coast and also for the northern and western environs of Aberdeen assuming for these areas an average height of 260 feet above sea level.

	<u>Apr</u>	<u>May</u>	<u>June</u>	<u>July</u>	<u>Aug</u>	<u>Sept</u>	<u>Summer Total</u>	<u>Winter Total</u>	<u>Annual Total</u>
	<u>P.T. in inches of water</u>								
Coastal Strip	2.20	3.00	3.30	3.20	2.50	1.80	16.00	3.65	19.65
Average Height 260 ft	2.00	2.90	3.20	3.05	2.35	1.60	15.10	1.95	17.05

The above averages of potential transpiration (P.T.) have been taken from 'Potential Transpiration' - Technical Bulletin No. 16 of the Ministry of Agriculture, Fisheries and Food - HMSO.

The calculated evaporation from percolation gauges and the water losses due to potential transpiration are not directly comparable with water losses from an open water surface. However, some seasonal ratios of potential transpiration to open water evaporation are published in 'The Calculation of Irrigation Need' - Technical Bulletin No. 4 of the Ministry of Agriculture, Fisheries and Food - HMSO, and it can be seen from these seasonal ratios (reproduced below) that during the main evaporation period of the year, the evaporation from an open water surface is of the order of 25 per cent higher than the losses due to potential transpiration.

<u>Period</u>	<u>Ratio of Potential Transpiration to Open Water Evaporation</u>
May to August	0.8
September to October and March to April	0.7
November to February	0.6

The available evidence suggests that the maximum evaporation from an open water surface in the Aberdeen area (i.e. during very warm weather with low humidities and fresh winds) is likely to be of the order of 0.3 inches in a day, 1.25 to 1.50 inches in a week and 3.00 to 4.00 inches in a month.

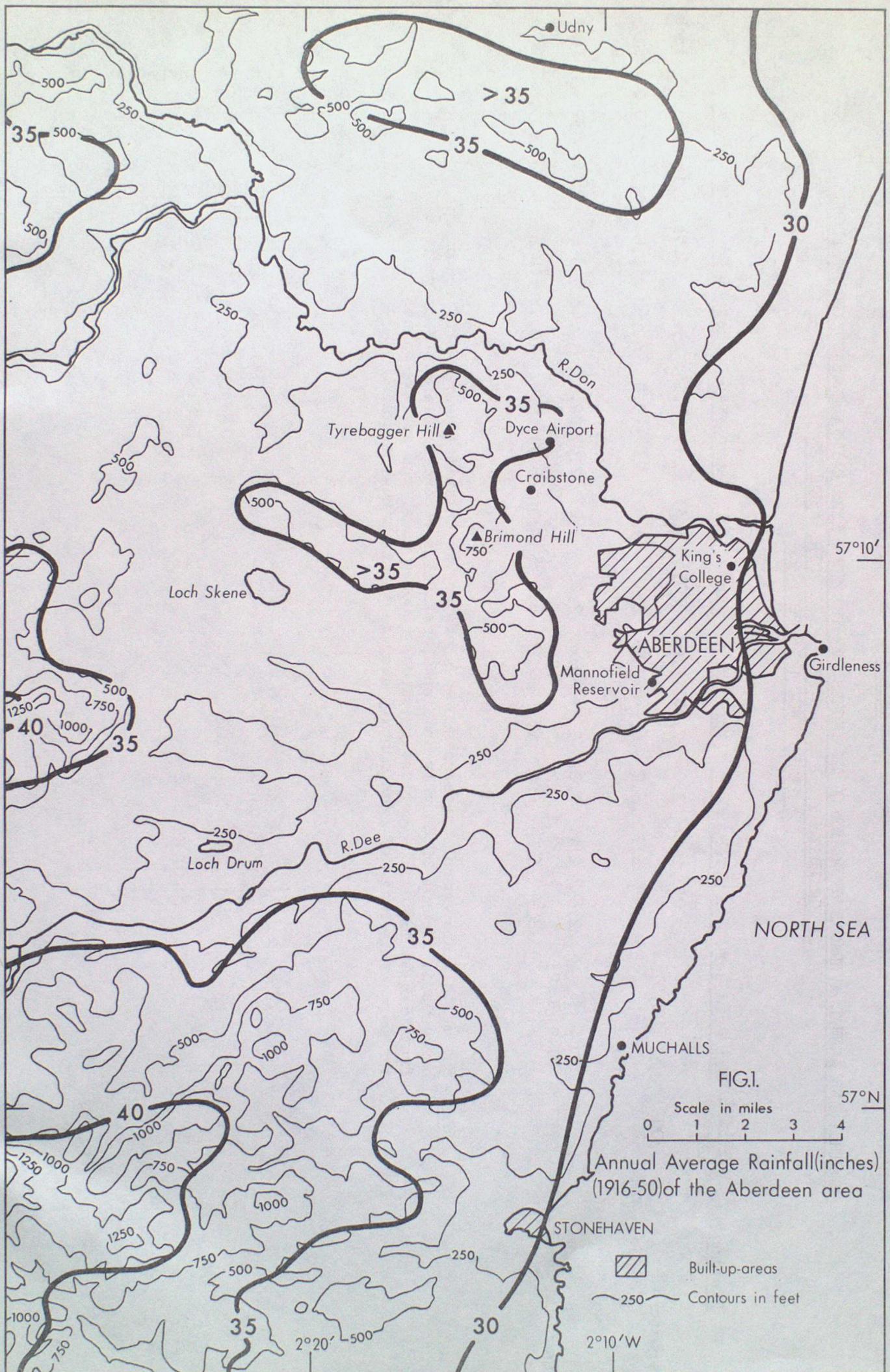


TABLE 1

MONTHLY AND ANNUAL AVERAGES OF RAINFALL IN INCHES FOR THE LONG TERM RAINFALL MEASURING STATIONS
AT CRAIBSTONE AND MANNOFIELD RESERVOIR, ABERDEEN
(35 YEARS FROM 1916 TO 1950)

<u>Station</u>	<u>Height (feet)</u>	<u>Nat Grid Ref</u>	<u>Jan</u>	<u>Feb</u>	<u>Mar</u>	<u>Apr</u>	<u>May</u>	<u>Jun</u>	<u>Jul</u>	<u>Aug</u>	<u>Sep</u>	<u>Oct</u>	<u>Nov</u>	<u>Dec</u>	<u>Year</u>
Craibstone	300	NJ 872107	3.03	2.26	2.04	2.20	2.68	2.05	3.33	2.98	3.05	3.59	3.53	3.16	33.90
			8.9	6.7	6.0	6.5	7.9	6.1	9.8	8.8	9.0	10.6	10.4	9.3	100.0
															%
Mannofield Reservoir	171	NJ 915042	2.84	2.11	2.01	2.21	2.61	2.08	3.29	2.87	2.97	3.43	3.40	3.11	32.93
			8.7	6.4	6.1	6.7	7.9	6.3	10.0	8.7	9.0	10.4	10.3	9.5	100.0
															%

NOTE: The monthly and annual averages quoted above are arithmetical averages of sound, homogeneous records of monthly and annual rainfalls recorded during the 35 years from 1916 to 1950. The percentage values (quoted under the average values) are the percentage ratio of each monthly average to the annual average.

TABLE 1A

MONTHLY AND ANNUAL AVERAGES OF RAINFALL IN INCHES ESTIMATED FROM SHORT TERM RECORDS OF RAINFALL MEASURING STATIONS
IN THE ABERDEEN AREA (35 YEARS 1916 TO 1950)

<u>Station</u>	<u>Height (feet)</u>	<u>Nat Grid Ref</u>	<u>Jan</u>	<u>Feb</u>	<u>Mar</u>	<u>Apr</u>	<u>May</u>	<u>Jun</u>	<u>Jul</u>	<u>Aug</u>	<u>Sep</u>	<u>Oct</u>	<u>Nov</u>	<u>Dec</u>	<u>Year (inches)</u>
Parkhill House, Dyce	170	NJ 898140	3.09	2.33	2.08	2.26	2.74	2.12	3.40	3.05	3.12	3.68	3.61	3.23	34.71
Dyce Airport	190	NJ 883125	3.14	2.36	2.12	2.29	2.78	2.15	3.45	3.10	3.17	3.74	3.67	3.28	35.25
Gordon Barracks	75	NJ 948098	2.65	1.95	1.85	2.04	2.40	1.91	3.04	2.65	2.74	3.16	3.13	2.89	30.41
Grandholm Works	30	NJ 928096	3.11	2.29	2.08	2.25	2.66	2.12	3.42	2.96	3.11	3.45	3.45	3.28	34.18
King's College	79	NJ 939081	2.64	1.94	1.86	2.03	2.40	1.91	3.03	2.64	2.73	3.15	3.12	2.88	30.33
Cornhill Road	150	NJ 928074	2.90	2.14	2.04	2.24	2.64	2.10	3.34	2.90	3.00	3.46	3.44	3.17	33.37
Rubislaw	200	NJ 916058	2.96	2.18	2.01	2.18	2.65	2.08	3.37	2.89	3.05	3.53	3.57	3.19	33.66
Girdleness	40	NJ 972054	2.48	1.82	1.73	1.91	2.25	1.80	2.85	2.48	2.57	2.96	2.94	2.71	28.50
Craigiebuckler	220	NJ 903045	3.08	2.31	2.10	2.31	2.77	2.17	3.50	3.08	3.12	3.72	3.62	3.26	35.04
Bielside	400	NJ 872036	3.09	2.37	2.12	2.33	2.79	2.22	3.51	3.05	3.12	3.76	3.73	3.41	35.50
Muchalls	210	NO 898919	2.56	1.87	1.73	1.93	2.35	1.87	3.06	2.65	2.71	3.19	3.06	2.77	29.75

TABLE 1B

CUMULATIVE MEAN DAILY RAINFALL IN INCHES, 35 YEARS FROM 1916 TO 1950

MANNOFIELD RESERVOIR, ABERDEEN

Date	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
1	0.13	2.93	5.07	7.07	9.20	11.87	13.94	17.28	20.12	23.10	26.57	29.92
2	0.24	3.01	5.11	7.17	9.26	11.96	14.02	17.37	20.20	23.19	26.71	30.02
3	0.34	3.11	5.23	7.26	9.34	12.02	14.13	17.40	20.31	23.32	26.83	30.12
4	0.45	3.19	5.28	7.35	9.45	12.10	14.24	17.47	20.42	23.44	26.96	30.21
5	0.54	3.28	5.34	7.41	9.57	12.21	14.35	17.53	20.46	23.58	27.10	30.28
6	0.61	3.39	5.39	7.45	9.73	12.31	14.45	17.61	20.61	23.66	27.21	30.36
7	0.69	3.47	5.43	7.54	9.82	12.36	14.64	17.70	20.72	23.81	27.37	30.48
8	0.77	3.55	5.48	7.62	9.94	12.46	14.72	17.83	20.84	23.92	27.44	30.59
9	0.85	3.61	5.53	7.66	10.01	12.51	14.80	17.87	20.93	24.04	27.55	30.72
10	0.94	3.69	5.58	7.73	10.05	12.62	14.93	17.95	21.04	24.19	27.67	30.84
11	1.04	3.75	5.65	7.79	10.12	12.65	15.05	18.02	21.08	24.27	27.78	31.00
12	1.15	3.81	5.70	7.91	10.19	12.73	15.15	18.17	21.15	24.37	27.86	31.10
13	1.23	3.86	5.73	7.95	10.28	12.79	15.30	18.27	21.31	24.45	27.95	31.21
14	1.33	3.95	5.77	8.05	10.33	12.88	15.39	18.36	21.38	24.51	28.03	31.33
15	1.41	4.01	5.84	8.11	10.48	12.93	15.47	18.49	21.44	24.58	28.14	31.44
16	1.49	4.07	5.92	8.18	10.58	12.97	15.55	18.59	21.60	24.65	28.26	31.57
17	1.57	4.14	5.96	8.28	10.69	13.03	15.67	18.68	21.69	24.78	28.42	31.66
18	1.69	4.21	6.03	8.34	10.76	13.08	15.80	18.77	21.79	24.86	28.61	31.73
19	1.75	4.26	6.11	8.40	10.80	13.12	15.94	18.82	21.98	24.94	28.71	31.81
20	1.85	4.32	6.16	8.46	10.88	13.19	16.09	18.93	22.13	25.03	28.86	31.94
21	1.94	4.39	6.22	8.51	10.98	13.26	16.24	19.06	22.19	25.12	28.95	32.01
22	2.05	4.44	6.29	8.57	11.04	13.30	16.31	19.13	22.35	25.26	29.05	32.12
23	2.15	4.52	6.36	8.65	11.11	13.35	16.38	19.20	22.48	25.40	29.24	32.19
24	2.27	4.56	6.41	8.73	11.20	13.42	16.45	19.25	22.56	25.50	29.30	32.27
25	2.36	4.61	6.47	8.82	11.29	13.47	16.58	19.41	22.65	25.66	29.40	32.38
26	2.41	4.70	6.54	8.87	11.37	13.56	16.65	19.49	22.74	25.81	29.49	32.54
27	2.45	4.79	6.63	8.97	11.46	13.64	16.75	19.56	22.82	25.92	29.60	32.59
28	2.51	4.88	6.69	9.07	11.54	13.71	16.85	19.70	22.88	26.08	29.69	32.66
29	2.63	4.95	6.80	9.13	11.57	13.77	16.94	19.83	22.91	26.20	29.76	32.77
30	2.71		6.89	9.17	11.67	13.86	17.03	19.92	22.99	26.33	29.82	32.86
31	2.84		6.96		11.78		17.15	20.02		25.42		32.93

Note: The entry opposite any particular date is the mean rainfall from January 1st to that date. The mean rainfall for any period of the year can be obtained from the table by subtracting the cumulative total at the beginning of the required period from the corresponding total at the end of the required period.

TABLE 1C

STATISTICS OF MONTHLY AND ANNUAL RAINFALLS FOR
MANNOFIELD RESERVOIR, ABERDEEN
(PERIOD OF RECORD - 56 YEARS FROM 1913 TO 1968)

Statistics of Monthly Rainfalls

<u>Month</u>	<u>Highest Monthly Rainfall</u>	<u>Monthly Rainfall Seldom* Above</u>	<u>Median†</u>	<u>Monthly Rainfall Seldom* Below</u>	<u>Lowest Monthly Rainfall</u>
January	5.70 inches in January 1937	3.83 inches	2.45 inches	1.62 inches	.89 inches in January 1954
February	5.72 inches in February 1923	2.95 inches	1.98 inches	1.11 inches	.19 inches in February 1959
March	4.43 inches in March 1932	2.99 inches	1.91 inches	1.00 inches	.30 inches in March 1953
April	6.70 inches in April 1934	2.77 inches	1.97 inches	1.30 inches	.37 inches in April 1918
May	5.78 inches in May 1924	3.47 inches	2.39 inches	1.23 inches	.35 inches in May 1956
June	4.98 inches in June 1935	2.82 inches	1.67 inches	1.18 inches	.61 inches in June 1940
July	8.82 inches in July 1940	4.51 inches	3.01 inches	1.67 inches	.58 inches in July 1913
August	6.32 inches in August 1930	4.27 inches	2.67 inches	1.40 inches	.01 inches in August 1947
September	6.38 inches in September 1927	4.14 inches	2.69 inches	1.50 inches	.61 inches in September 195
October	7.74 inches in October 1960	4.41 inches	3.28 inches	1.68 inches	.44 inches in October 1962
November	7.55 inches in November 1951	4.72 inches	3.25 inches	1.70 inches	.54 inches in November 1958
December	7.70 inches in December 1929	4.36 inches	3.15 inches	1.86 inches	1.02 inches in December 1962

Statistics of Annual Rainfalls

<u>Period of record</u>	<u>Highest Annual Rainfall</u>	<u>Annual Rainfall Seldom* Above</u>	<u>Median†</u>	<u>Annual Rainfall Seldom* Below</u>	<u>Lowest Annual Rainfall</u>
56 years	39.81 inches in 1923	36.37 inches	32.03 inches	27.84 inches	17.01 inches in 1921

*Seldom = 20 per cent of occasions or one year in five;
the figures given are the upper and lower quintiles.

†Median = the "middle" value i.e. half the rainfalls exceed it
and half fall below it.

TABLE 1D

CUMULATIVE FREQUENCIES OF DAILY RAINFALL AMOUNTS IN INCHES
FOR MANNOFIELD RESERVOIR, ABERDEEN
(50 YEARS FROM 1916 TO 1965)

Daily Totals	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	All Months
3.00 inches or more										1			1
2.70 " " "										2	1		3
2.60 " " "			1							2	1		4
2.50 " " "			1				1			2	1	1	6
2.40 " " "			1				1			2	1	1	6
2.30 " " "			1				1	1		2	2	1	9
2.20 " " "			1				1	1	2	2	1	1	9
2.10 " " "			1	1		1	1	1	2	2	1	1	11
2.00 " " "			1	1		1	1	1	3	2	1	1	12
1.90 " " "			1	1		1	3	1	3	2	1	1	14
1.80 " " "			1	1		2	3	1	3	2	2	1	16
1.70 " " "			1	1	1	2	4	2	4	3	2	1	21
1.60 " " "			1	1	1	2	5	3	4	3	2	1	23
1.50 " " "			3	1	1	2	7	3	4	3	2	1	27
1.40 " " "			3	1	4	2	8	3	7	4	3	2	37
1.30 " " "			3	1	4	2	10	5	8	4	4	3	44
1.20 " " "	1		4	1	4	3	11	7	11	6	5	3	56
1.10 " " "	2	1	5	1	6	4	17	13	14	7	8	4	82
1.00 " " "	3	1	5	1	13	6	19	17	20	11	12	10	118
0.90 " " "	9	8	5	3	15	7	26	21	23	20	14	17	168
0.80 " " "	11	8	8	10	18	10	33	30	28	30	21	27	234
0.70 " " "	20	10	15	17	26	13	43	36	40	41	32	36	329
0.60 " " "	34	14	25	22	36	17	56	50	52	57	56	47	466
0.50 " " "	52	30	41	37	46	30	78	69	75	80	78	66	682
0.40 " " "	86	56	60	56	70	46	105	98	100	117	114	100	1008
0.30 " " "	136	97	84	95	109	83	165	164	139	168	169	159	1568
0.20 " " "	229	158	150	168	188	164	268	255	211	254	271	256	2572
0.10 " " "	409	314	300	315	353	316	423	405	357	424	478	432	4526
0.005 " " "	981	823	843	864	795	784	871	851	848	941	995	1015	10611
*Less than .005 inches	569	590	707	636	755	716	679	699	652	609	505	535	7652
Total Number of Days in 50 years	1550	1413	1550	1500	1550	1500	1550	1550	1500	1550	1500	1550	18263

*Including days with no rain.

Example: In the 50 Januarys during the years from 1916 to 1965, there was a total of 52 days with 24 hour rainfall amounts of 0.50 inches or more.

Note: The contents of the raingauge at Mannofield Reservoir, Aberdeen, are emptied and measured once-daily at 0900 hours Greenwich Mean Time (10 a.m. British Standard Time) to obtain the 24 hour amount of precipitation collected in the gauge since the measurement made at 0900 hours on the previous day. When the gauge contains solid precipitation in the form of hail or snow, the contents are melted by warming to give the equivalent amount of rainwater. The above frequency table has been calculated from records of the 24 hour (0900 hours on one day to 0900 hours on the next day) measurements made during the 50 years period from 1916 to 1965. The rainfall measured at 0900 hours GMT is credited to the previous day.

TABLE 1E
MAXIMUM DAILY RAINFALLS IN INCHES RECORDED AT MANNOFIELD RESERVOIR, ABERDEEN,
DURING THE 57 YEARS FROM 1912 TO 1968

	<u>Jan</u>	<u>Feb</u>	<u>Mar</u>	<u>Apr</u>	<u>May</u>	<u>Jun</u>	<u>Jul</u>	<u>Aug</u>	<u>Sep</u>	<u>Oct</u>	<u>Nov</u>	<u>Dec</u>
Maximum Daily* Fall	1.24	1.10	2.62	2.19	1.79	2.14	2.58	2.31	2.76	3.01	2.51	2.30
Year of Occurrence	1931	1926	1964	1934	1943	1935	1929	1916	1927	1941	1951	1929

*24 hours from 09h. G.M.T. on one day to 09h. G.M.T. on the next day.

Example:-

The maximum daily rainfall of 1.24 inches which occurred in January 1931 is the highest daily rainfall recorded at Mannofield Reservoir in any January during the years from 1912 to 1968.

TABLE 1F

DAILY RAINFALLS AT MANNOFIELD RESERVOIR, ABERDEEN DURING THE EIGHT WETTEST MONTHS IN THE 56 YEARS FROM 1913 TO 1968

(Wettest Month = Month with total of more than 7 inches (178 millimetres) of rain)

Date	December 1929	October 1932	July 1940	November 1940	November 1946	November 1951	July 1957	October 1960
	(inches)	(inches)	(inches)	(inches)	(inches)	(inches)	(inches)	(inches)
1st	.07	.06	.02	.05	.22	Trace	.22	.02
2nd	.25	.03	.27	.88	.06	.70	.03	.72
3rd	.24	.02	.40	Nil	.02	.07	.05	.63
4th	.25	Nil	.25	Nil	.01	.15	Nil	.26
5th	.02	.05	.14	1.30	Nil	2.51	Nil	Trace
6th	.40	.01	.47	.79	.36	.66	.55	.01
7th	.05	.65	.08	.02	.08	.02	.02	.06
8th	.03	.89	.12	.18	Nil	.41	Nil	.09
9th	.01	.37	.07	.43	Nil	.03	Nil	.03
10th	.14	.70	1.95	.08	.02	.54	Nil	.05
11th	.24	.01	.96	.36	Nil	.52	.54	.18
12th	.10	.18	.38	.35	.17	.09	.22	.13
13th	.01	.41	.03	.33	.14	Trace	.18	.17
14th	Nil	.40	.12	.09	Nil	.36	Nil	.15
15th	Nil	.06	Nil	.06	.58	.01	.03	.12
16th	Nil	.11	.01	.71	.20	.16	.01	.10
17th	.03	.84	1.00	.52	.65	.03	.23	Trace
18th	Nil	.02	.02	.26	.47	.33	1.76	.11
19th	.15	.13	.24	.15	.35	.05	1.66	.16
20th	2.30	Nil	.36	.40	1.04	Trace	.81	.30
21st	.42	.28	.25	Nil	.03	.04	Nil	.11
22nd	.90	.51	.15	Nil	.01	Nil	Nil	.26
23rd	.46	.01	.01	Nil	.20	.55	.03	.69
24th	1.00	.01	.82	Nil	.22	.01	.28	.33
25th	.24	.28	.59	Nil	.64	.02	.43	1.18
26th	.04	.47	.03	.03	.37	.02	.02	.24
27th	Nil	.10	Nil	.10	.37	.10	Trace	.04
28th	.35	.06	.02	.17	.58	.17	Nil	.21
29th	Nil	.40	.01	Nil	.02	Trace	Nil	.84
30th	Nil	.35	.05	.04	.21	Nil	Nil	.53
31st	Nil	Nil	Nil				Nil	.02
Totals	7.70	7.41	8.82	7.30	7.02	7.55	7.04	7.74

Notes

1. The "daily" rainfalls quoted above relate to the 24 hour period following 0900 hours Greenwich Mean Time on the date to which they have been credited.
2. A 'Trace' of rainfall is a very small amount less than .005 inches.

TABLE 1G

TOTAL DURATIONS IN HOURS OF MEASURABLE* RAIN RECORDED IN EACH MONTH AND YEAR
DURING THE 20 YEARS FROM 1949 TO 1968 BY THE AUTOGRAPHIC RAIN RECORDER AT
DYCE (ABERDEEN) AIRPORT

<u>Year</u>	<u>Jan</u>	<u>Feb</u>	<u>Mar</u>	<u>Apr</u>	<u>May</u>	<u>Jun</u>	<u>Jul</u>	<u>Aug</u>	<u>Sep</u>	<u>Oct</u>	<u>Nov</u>	<u>Dec</u>	<u>Year</u>
	<u>Hours</u>												
1949	41.2	18.9	48.3	23.2	41.0	39.9	37.4	59.4	43.9	48.5	110.3	35.7	547.7
1950	56.1	53.7	42.6	35.6	37.6	29.3	56.4	33.3	89.3	30.9	65.3	57.0	587.1
1951	68.4	66.6	70.0	63.8	48.7	45.5	71.2	65.7	23.3	14.7	118.3	39.7	695.9
1952	56.6	29.2	75.5	29.5	47.2	52.7	29.5	47.5	31.3	33.8	70.8	69.8	573.4
1953	27.6	47.7	4.0	56.5	41.8	61.5	78.1	29.2	75.9	28.6	57.1	65.8	573.8
1954	22.7	76.8	49.4	23.5	79.0	55.2	41.5	71.3	28.0	74.2	76.3	63.8	661.7
1955	38.4	67.0	65.6	24.4	57.5	31.2	21.8	10.2	23.1	69.3	44.3	91.0	543.8
1956	84.7	53.7	28.6	46.0	14.1	40.9	72.9	53.4	45.9	53.8	38.2	78.4	610.6
1957	42.4	57.7	50.9	34.7	38.2	32.0	105.5	63.8	49.4	38.5	43.4	61.5	618.0
1958	80.1	87.1	85.2	39.2	49.3	29.2	88.1	66.6	31.5	28.3	19.8	79.4	683.8
1959	57.9	12.2	33.0	56.9	16.0	34.0	20.8	22.3	20.2	49.4	60.5	90.8	474.0
1960	105.4	67.1	45.4	38.1	9.0	21.1	71.3	79.1	57.1	147.4	85.8	42.6	769.4
1961	56.6	40.5	26.0	57.0	16.7	31.2	65.0	71.0	41.3	58.1	21.9	75.3	560.6
1962	52.8	32.6	73.0	43.7	44.6	27.9	46.6	76.3	78.1	20.1	101.1	90.5	687.3
1963	52.8	60.1	70.1	49.4	50.5	66.9	42.9	100.4	54.3	29.8	125.0	36.1	738.3
1964	24.6	37.3	78.2	35.6	37.0	42.9	32.5	80.8	74.1	37.8	21.0	46.4	548.2
1965	58.8	38.8	41.7	56.2	43.8	40.9	70.8	43.1	94.6	26.4	70.8	84.9	670.8
1966	83.1	74.3	49.2	59.2	65.4	66.4	50.7	87.3	37.8	70.4	83.6	84.8	812.2
1967	92.5	48.7	24.4	44.3	105.3	28.5	24.8	48.4	46.8	71.3	67.1	53.2	655.3
1968	46.0	34.3	28.5	44.6	94.7	23.1	94.0	31.4	38.8	81.0	40.8	59.7	616.9
20 year means	57.4	50.2	49.5	43.1	46.9	40.0	56.1	57.0	49.2	50.6	66.1	65.3	631.4

*The autographic rain recording instrument does not register the duration of very small amounts of rain, drizzle, snow etc., e.g. occasions with only a few "spots" of rain.

TABLE 1H
INTENSITIES OF RAINFALL RECORDED AT DYCE (ABERDEEN) AIRPORT

Number of Days with Specified Amounts of Rain falling in specified times (23 years from 1946 to 1968)

Year	Amount of 5 mm (0.2 inch) falling within			Amount of 10 mm (0.4 inch) falling within			Amount of 15 mm (0.6 inch) falling within			Amount of 20 mm (0.8 inch) falling within			Amount of 25 mm (1.0 inch) falling within				
	5 mins	10 mins	15 mins	5 mins	15 mins	30 mins	1 hr	1 hr	2 hrs	4 hrs	30 mins	1 hr	2 hrs	4 hrs	8 hrs	16 hrs	
1946	-	-	-	0	1	1	2	1	1	4	1	1	0	0	3	0	2
1947	-	-	-	0	0	0	0	0	0	4	0	0	0	0	4	0	2
1948	-	-	-	0	1	1	1	1	1	4	1	1	1	0	5	2	4
1949	-	-	-	0	0	0	1	0	0	2	0	0	0	0	2	0	2
1950	-	-	-	0	0	0	0	0	0	1	0	0	0	0	3	0	3
1951	-	-	-	0	0	0	1	0	0	4	0	0	0	0	4	5	0
1952	-	-	-	0	0	0	0	0	0	1	0	0	0	0	1	0	2
1953	-	-	-	0	0	1	2	1	1	2	0	0	1	1	2	2	2
1954	-	-	-	0	0	0	0	0	0	1	0	0	0	0	3	1	3
1955	-	-	-	0	0	0	1	0	0	3	0	0	0	0	5	3	5
1956	0	2	3	0	0	0	0	0	0	2	0	0	0	0	2	2	3
1957	1	3	3	0	0	0	2	0	0	4	0	0	0	0	3	3	2
1958	0	1	2	0	0	0	2	0	1	4	0	0	0	0	2	3	0
1959	0	2	2	0	0	0	2	0	0	2	0	0	0	0	2	2	6
1960	0	0	1	0	0	1	1	0	0	1	0	0	0	0	1	0	2
1961	0	0	0	0	0	0	0	0	0	5	0	0	0	0	2	1	4
1962	0	0	0	0	0	0	1	0	0	1	0	0	0	0	1	0	2
1963	0	0	0	0	0	0	1	0	0	1	0	0	0	0	4	0	4
1964	0	0	1	0	0	0	1	0	0	1	0	0	0	0	1	0	1
1965	0	0	0	0	0	0	0	0	0	1	0	0	0	0	3	2	4
1966	0	1	1	0	0	0	1	0	0	3	0	0	0	1	4	3	3
1967	0	0	0	0	0	0	0	0	0	1	0	0	0	0	3	0	2
1968	0	2	3	0	0	0	2	0	0	4	0	0	0	0	3	0	2
Total	3	12	17	0	2	6	22	2	3	58	2	2	3	20	66	0	61
Number of Years of record	13	13	13	23	23	23	23	23	23	23	23	23	23	23	23	23	23

Note: Records of amounts of 5 millimetres (0.2 inch) falling within 5 minutes, 10 minutes and 15 minutes are not available for the years before 1956.

TABLE 11

MAXIMUM RAINFALL IN INCHES FROM MODIFIED BILHAM FORMULA

Duration (minutes)	<u>Return Period (years)</u>						
	1 day per Annum	1 day per 2 years	1 day per 5 years	1 day per 10 years	1 day per 20 years	1 day per 50 years	1 day per 100 years
2 minutes or less	0.09	0.11	0.14	0.16	0.19	0.22	0.24
4 " " "	0.15	0.18	0.23	0.27	0.31	0.36	0.40
6 " " "	0.18	0.23	0.30	0.35	0.40	0.48	0.54
8 " " "	0.21	0.27	0.35	0.41	0.48	0.58	0.65
10 " " "	0.24	0.30	0.39	0.47	0.55	0.66	0.75
15 " " "	0.28	0.36	0.48	0.58	0.68	0.83	0.96
20 " " "	0.31	0.40	0.54	0.66	0.79	0.97	1.12
25 " " "	0.34	0.43	0.58	0.72	0.87	1.09	1.27
30 " " "	0.36	0.46	0.62	0.77	0.94	1.18	1.39
40 " " "	0.40	0.50	0.68	0.85	1.05	1.34	1.59
50 " " "	0.43	0.54	0.73	0.91	1.13	1.46	1.75
60 " " "	0.46	0.58	0.78	0.96	1.19	1.56	1.88
90 " " "	0.52	0.66	0.88	1.09	1.35	1.78	2.18
120 " " "	0.58	0.72	0.96	1.19	1.47	1.94	2.38

Example: The maximum rainfall in 60 minutes or less on one day in
50 years = 1.56 inches.

FACTORS FOR CONVERTING POINT RAINFALLS INTO AREAL RAINFALLS

Area (acres)	<u>Duration (minutes)</u>						
	2	6	10	15	30	60	120
100	0.94	0.95	0.96	-	-	-	-
150	0.92	0.94	0.95	0.95	0.96	-	-
200	0.91	0.93	0.94	0.94	0.95	0.95	0.96
300	0.89	0.91	0.92	0.93	0.94	0.94	0.95
500	0.86	0.89	0.90	0.91	0.92	0.92	0.93
700	0.83	0.87	0.88	0.89	0.90	0.91	0.92
1000	0.80	0.85	0.86	0.87	0.88	0.89	0.90
1500	0.75	0.81	0.83	0.84	0.86	0.87	0.88
2000	-	-	0.80	0.82	0.83	0.85	0.86
3000	-	-	-	0.78	0.80	0.82	0.83
5000	-	-	-	-	0.74	0.76	0.77
7000	-	-	-	-	-	0.72	0.73

TABLE 1J

COMPARISON OF OBSERVED AND ESTIMATED INTENSITIES OF RAINFALL
FOR THE ABERDEEN AREA

Number of Days in 10 years with specified amounts of rain falling
in specified times

	A.	B.	C.	D.
	<u>Observed</u> <u>Frequency</u> (number of days in 10 years)	<u>Estimated</u> <u>Frequency</u> (number of days in 10 years)	<u>Observed Fre-</u> <u>quency as</u> <u>Percentage of</u> <u>Estimated</u> <u>Frequency</u>	<u>Period of</u> <u>Record used</u> <u>for Calcula-</u> <u>tion of A.</u> (years)
<u>Amount of 0.2 inches falling within:</u>				
5 minutes or less	2.3	5.5*	42%	13
10 minutes or less	9.2	14.9	62%	13
15 minutes or less	13.1	22.3	59%	13
<u>Amount of 0.4 inches falling within:</u>				
15 minutes or less	0.9	3.5*	26%	23
30 minutes or less	2.6	7.3	36%	23
60 minutes or less	9.6	14.6	66%	23
<u>Amount of 0.6 inches falling within:</u>				
15 minutes or less	0.9	0.9*	100%	23
30 minutes or less	1.3	2.2	59%	23
1 hour or less	1.3	4.4	30%	23
2 hours or less	6.1	8.8	69%	23
4 hours or less	25.2	17.6	14.3%	23
<u>Amount of 0.8 inches falling within:</u>				
30 minutes or less	0.9	0.8*	113%	23
1 hour or less	0.9	1.8	50%	23
2 hours or less	1.3	3.6	36%	23
4 hours or less	8.7	7.2	121%	23
8 hours or less	28.7	14.4	199%	23
<u>Amount of 1.0 inches falling within:</u>				
2 hours or less	0.4	1.8	22%	23
4 hours or less	1.7	3.6	47%	23
8 hours or less	10.4	7.2	144%	23
16 hours or less	26.5	14.4	184%	23

Notes

1. The observed frequencies in column 'A' above have been calculated from intensities of rainfall recorded at Dyce (Aberdeen) Airport during the 23 years from 1946 to 1968 - see column 'D' for period of record used.
2. The estimated frequencies in column 'B' above were mainly obtained from Bilham's formula:-

$$n = \frac{1.25t}{(r + 0.1) 3.55}$$

where:

n = frequency (number of days in 10 years)
t = duration in hours
r = rainfall in inches

But the following modification due to D. J. Holland for intensities greater than 1.25 inches per hour was used to estimate the frequencies marked with an asterisk:-

$$n = \frac{r \exp. \left(1 - \frac{0.8r}{t}\right)}{(r + 0.1) 3.55}$$

TABLE 1K

NUMBER OF DAYS WITH 0.1 MILLIMETRES OR MORE OF RAIN FALLING AT SOME TIME DURING
THE 10 HOUR PERIOD BETWEEN 0700 AND 1700 HOURS GREENWICH MEAN TIME (0800
AND 1800 HOURS BRITISH STANDARD TIME) IN EACH MONTH AND YEAR
DURING THE 10 YEARS FROM 1959 TO 1968 AT
DYCE (ABERDEEN) AIRPORT

<u>Year</u>	<u>Jan</u>	<u>Feb</u>	<u>Mar</u>	<u>Apr</u>	<u>May</u>	<u>Jun</u>	<u>Jul</u>	<u>Aug</u>	<u>Sep</u>	<u>Oct</u>	<u>Nov</u>	<u>Dec</u>	<u>Year Total</u>
<u>Number of Days</u>													
1959	17	5	8	14	8	10	7	3	4	8	14	19	117
1960	13	14	10	8	2	11	18	21	11	25	20	10	163
1961	12	8	9	9	7	11	11	16	9	15	4	11	122
1962	10	7	17	10	14	6	11	17	13	11	19	17	152
1963	16	16	13	12	16	9	17	15	11	5	18	14	162
1964	7	9	14	7	8	9	8	12	11	11	8	14	118
1965	18	15	7	13	15	13	11	12	14	5	18	20	161
1966	14	14	14	10	15	9	14	16	9	14	13	15	157
1967	17	8	10	9	15	7	7	12	8	12	12	14	131
1968	14	7	12	12	14	8	13	9	7	11	15	12	134
10 year mean	13.8	10.3	11.4	10.4	11.4	9.3	11.7	13.3	9.7	11.7	14.1	14.6	141.7

NUMBER OF HOURS DURING THE 10 HOUR PERIOD BETWEEN 0700 AND 1700 HOURS GREENWICH
MEAN TIME WITH 0.1 MILLIMETRES OR MORE OF RAIN FALLING AT SOME TIME
DURING THE HOUR IN EACH MONTH AND YEAR DURING THE 10 YEARS
FROM 1959 TO 1968 AT DYCE (ABERDEEN) AIRPORT

<u>Year</u>	<u>Jan</u>	<u>Feb</u>	<u>Mar</u>	<u>Apr</u>	<u>May</u>	<u>Jun</u>	<u>Jul</u>	<u>Aug</u>	<u>Sep</u>	<u>Oct</u>	<u>Nov</u>	<u>Dec</u>	<u>Year Total</u>
<u>Number of Hours</u>													
1959	64	15	19	43	16	35	17	7	21	34	51	71	393
1960	65	48	32	33	4	25	52	80	38	133	74	32	616
1961	45	35	20	26	19	31	43	54	27	52	21	50	423
1962	47	23	61	32	36	12	31	65	52	25	83	76	543
1963	54	53	42	21	56	37	52	53	34	18	81	50	551
1964	31	27	43	20	21	27	23	41	39	34	13	45	364
1965	51	44	17	40	36	35	42	27	53	14	62	80	501
1966	62	59	37	39	41	28	30	50	26	59	55	60	546
1967	74	26	23	36	59	18	16	30	23	51	36	42	434
1968	50	32	22	44	47	18	56	27	28	54	40	61	479
10 year mean	54.3	36.2	31.6	33.4	33.5	26.6	36.2	43.4	34.1	47.4	51.6	56.7	485.0

10 year mean
expressed as
percentage of 18% 13% 10% 11% 11% 9% 12% 14% 11% 15% 17% 18% 13%
total working
time

TABLE 1L

TOTAL DURATION IN HOURS AND TENTHS OF RAIN FALLING AT A RATE OF 0.5 MILLIMETRES
OR MORE PER HOUR BETWEEN THE HOURS OF 0700 AND 1700 HOURS GREENWICH
MEAN TIME (0800 AND 1800 HOURS BRITISH STANDARD TIME) IN EACH
MONTH AND YEAR DURING THE 10 YEARS FROM 1959 TO 1968 AT
DYCE (ABERDEEN) AIRPORT

<u>Year</u>	<u>Jan</u>	<u>Feb</u>	<u>Mar</u>	<u>Apr</u>	<u>May</u>	<u>Jun</u>	<u>Jul</u>	<u>Aug</u>	<u>Sep</u>	<u>Oct</u>	<u>Nov</u>	<u>Dec</u>	<u>Year</u> <u>Total</u>
<u>Total Duration in Hours and Tenths</u>													
1959	22.2	1.8	7.4	15.8	4.5	11.1	6.8	1.8	8.4	17.1	16.8	37.3	151.0
1960	40.4	19.6	4.5	16.0	0.5	8.7	23.3	35.5	17.6	55.5	35.2	13.9	270.7
1961	22.2	20.6	6.3	12.3	4.3	11.6	24.1	23.3	15.8	21.3	5.0	22.7	189.5
1962	22.3	7.0	23.3	12.6	17.5	5.3	15.6	35.3	24.9	6.2	33.2	28.3	231.5
1963	19.7	15.1	16.4	6.0	23.5	12.1	23.3	27.5	16.4	10.6	40.2	8.1	218.9
1964	11.8	7.5	18.3	13.3	6.8	12.6	6.8	22.0	18.7	13.9	5.3	11.9	148.9
1965	23.3	12.8	6.0	17.3	13.3	14.2	15.2	6.3	24.8	7.5	19.7	32.6	193.0
1966	19.4	37.5	14.0	17.5	19.2	17.5	6.7	21.3	13.6	34.5	24.8	26.7	252.7
1967	40.2	14.9	7.8	9.9	34.8	9.9	4.4	9.9	7.6	24.3	17.9	13.8	195.4
1968	25.2	18.6	6.7	17.4	24.9	5.4	29.7	13.1	17.3	33.9	8.4	23.7	224.3
10 year mean	24.7	15.5	11.1	13.8	14.9	10.8	15.6	19.6	16.5	22.5	20.7	21.9	207.6
10 year mean expressed as percentage of total working time	8%	6%	4%	5%	5%	4%	5%	6%	6%	7%	7%	7%	6%

TABLE 1M

NUMBER OF DAYS WITH RAIN FALLING AT A RATE OF 0.5 MILLIMETRES OR MORE PER HOUR
BETWEEN THE HOURS OF 0700 AND 1700 HOURS GREENWICH MEAN TIME (0800 AND
1800 HOURS BRITISH STANDARD TIME) IN EACH MONTH AND YEAR DURING
THE 10 YEARS PERIOD FROM 1959 TO 1968 AT
DYCE (ABERDEEN) AIRPORT

<u>Year</u>	<u>Jan</u>	<u>Feb</u>	<u>Mar</u>	<u>Apr</u>	<u>May</u>	<u>Jun</u>	<u>Jul</u>	<u>Aug</u>	<u>Sep</u>	<u>Oct</u>	<u>Nov</u>	<u>Dec</u>	<u>Year</u> <u>Total</u>
<u>Number of Days</u>													
1959	16	4	8	13	7	10	6	2	4	7	14	19	110
1960	13	14	7	8	2	10	16	19	9	24	18	9	149
1961	11	8	9	9	6	10	11	16	9	14	3	10	116
1962	9	6	15	9	12	5	9	17	12	9	19	15	137
1963	16	13	13	10	14	7	17	14	9	5	17	12	147
1964	7	8	10	6	7	9	5	12	11	11	6	13	105
1965	17	13	7	13	14	11	11	10	14	4	17	19	150
1966	11	13	14	8	11	8	11	13	7	14	13	13	136
1967	17	8	9	9	15	7	5	10	6	11	11	14	122
1968	14	6	9	12	11	7	13	8	6	11	14	11	122
10 year mean	13.1	9.3	10.1	9.7	9.9	8.4	10.4	12.1	8.7	11.0	13.2	13.5	129.4

NUMBER OF HOURS WITH RAIN FALLING AT A RATE OF 0.5 MILLIMETRES OR MORE PER HOUR
BETWEEN THE HOURS OF 0700 AND 1700 HOURS GREENWICH MEAN TIME (0800 AND
1800 HOURS BRITISH STANDARD TIME) IN EACH MONTH AND YEAR DURING
THE 10 YEARS PERIOD FROM 1959 TO 1968 AT
DYCE (ABERDEEN) AIRPORT

<u>Year</u>	<u>Jan</u>	<u>Feb</u>	<u>Mar</u>	<u>Apr</u>	<u>May</u>	<u>Jun</u>	<u>Jul</u>	<u>Aug</u>	<u>Sep</u>	<u>Oct</u>	<u>Nov</u>	<u>Dec</u>	<u>Year</u> <u>Total</u>
<u>Number of Hours</u>													
1959	52	10	18	32	15	31	16	3	13	31	46	64	331
1960	58	40	14	27	4	23	41	68	27	103	62	26	493
1961	43	34	18	19	17	25	37	49	23	46	18	40	369
1962	39	20	47	30	32	9	26	60	33	19	68	57	440
1963	48	40	27	18	43	24	48	45	27	14	57	34	425
1964	25	21	28	17	13	23	14	33	30	27	9	29	269
1965	47	36	14	35	30	26	34	20	40	11	54	57	404
1966	35	46	31	25	27	25	19	34	19	51	46	40	398
1967	59	18	21	29	50	15	12	15	16	44	33	39	351
1968	41	27	18	37	35	15	44	20	24	47	33	53	394
10 year mean	44.7	29.2	23.6	26.9	26.6	21.6	29.1	34.7	25.2	39.3	42.6	43.9	387.4
10 year mean expressed as percentage of total working time	14%	10%	8%	9%	9%	7%	9%	11%	8%	13%	14%	14%	11%

NOTE: The numbers of days and numbers of hours quoted in the above tables should not be taken to mean that rain has fallen continuously at a rate of 0.5 millimetres or more per hour throughout the day between 0700 and 1700 hours or continuously at the same rate throughout an hour during this period. For example, the above tables include days and hours when rain fell at a rate of 0.5 millimetres or more per hour for only a few minutes.

TABLE 1N

TABLE FOR CONVERTING AMOUNTS OF RAINFALL IN MILLIMETRES TO INCHES

<u>mm</u>	<u>inch</u>	<u>mm</u>	<u>inch</u>	<u>mm</u>	<u>inch</u>
.1	.004	10	.394	100	3.937
.2	.008	15	.591	200	7.874
.3	.012	20	.787	300	11.811
.4	.016	25	.984	400	15.748
.5	.020	30	1.181	500	19.685
.6	.024	35	1.378	600	23.622
.7	.028	40	1.575	700	27.559
.8	.031	45	1.772	800	31.496
.9	.035	50	1.969	900	35.433
				1000	39.370
1	.039	55	2.165		
2	.079	60	2.362		
3	.118	65	2.559		
4	.157	70	2.756		
5	.197	75	2.953		
6	.236	80	3.150		
7	.276	85	3.346		
8	.315	90	3.543		
9	.354	95	3.740		
10	.394	100	3.937		

2. TEMPERATURE

As mentioned earlier, winter temperatures in Aberdeen are comparable with places on the eastern side of England, but because of the higher latitude, the very slow rise in sea temperature at the end of winter and an increased frequency of cold easterly and northerly winds in the spring, the rise of temperature at the end of winter is much more of an uphill struggle. Consequently, the wintry period is longer in Aberdeen than in England, and spring is later and cooler.

In summer and early autumn, the effect of latitude on the heat received from the sun is the dominant factor and temperatures in the Aberdeen area are several degrees lower than in the south of England.

Averages and Extremes of Maximum, Minimum and Mean Temperature for temperature recording stations in the Aberdeen area are given in Tables 2, 2A and 2B.

Statistics of Monthly and Annual Mean Temperatures for Craibstone, the oldest established temperature recording station in the Aberdeen area, are given in Table 2C.

Statistics of Monthly and Annual Maximum and Minimum Temperatures are given in Tables 2D, 2E and 2F.

The reader will notice from the statistics that the maximum temperatures are remarkably uniform from place to place in the Aberdeen area, but a maximum temperature seldom persists for more than an hour or two and it would be reasonable to assume that temperatures in a low-lying part of Aberdeen near the sea front would be higher for a longer period of time than at a place like Craibstone which lies a few miles inland at an altitude of 300 feet. Indeed it would be reasonable to expect something like the normal decrease of one degree Fahrenheit in mean temperature per 300 feet increase in altitude.

In contrast to the uniformity of the maximum temperatures, it can be seen that there is a considerable variation in minimum temperatures. These differences in minimum temperature from place to place are attributable much more to the downhill drainage and stagnation of cold air (i.e. the "frost hollow" effect)

than to the effect of increasing altitude and there is little doubt that on clear calm nights, particularly in winter, the cold air is able to drain down the valleys and slopes into low-lying places in the main built-up area of the city. Some of the most densely built-up parts of Aberdeen are in hollows or at the foot of slopes, and the "frost hollow" effect may be counteracted to some extent by the artificial "heat island" effect which large built-up areas create particularly during the night period.

The Percentage Number of Occasions with Air Temperatures at or below certain limits are given in Table 2G.

The Number of Days with Maximum Air Temperatures exceeding 60°F, 65°F, 70°F, 75°F and 80°F are given in Table 2H.

Highest Values of Dry and Wet Bulb Temperature recorded at 3-hourly intervals are given in Table 2I. Records of the highest values of wet-bulb temperature associated with relative humidities of 100 per cent are not readily available for Dyce Airport, but the values quoted below for Kinloss in Morayshire (based on hourly readings during a 10-year period) should be reasonably representative of the Aberdeen area.

	<u>Highest Value of Wet-Bulb Temperature associated with Relative Humidity of 100 per cent °F</u>
January	52
February	52
March	54
April	56
May	62
June	64
July	64
August	64
September	64
October	60
November	54
December	54
Year	64

The Actual and Average Numbers of Days with Air Frost for certain temperature recording stations in the Aberdeen area are given in Table 2J.

The Average and Extreme Dates of the First and Last Air Frosts are given in Table 2K.

Averages and Extremes of Soil and Earth Temperature at depths of 4 inches, 12 inches and 4 feet, calculated from readings made at Craibstone, are given in Table 2L. Craibstone is the only location in the Aberdeen area for which records of soil and earth temperatures are available.

Low Temperatures during the Working Part of the Day

Experience suggests that building contractors are interested in the number of working days and working hours with air temperatures "below 36°F", "below 34°F" and "below 32°F" during the winter months. Tables 2M, 2N and 2O which provide this type of information have been prepared from records of hourly readings of air temperature made at Dyce (Aberdeen) Airport between 0700 and 1700 hours Greenwich Mean Time (0800 and 1800 hours British Standard Time) on each day during the 10 years from 1959 to 1968.

The number of days quoted in these Tables may slightly underestimate the true number of days on which the air temperature fell to below the stated levels because on several days the minimum air temperature could have fallen below these levels for a short time during the 60 minutes between the routine hourly readings.

It should be borne in mind when consulting Tables 2M, 2N and 2O that there will be occasions when the ground is frozen for several hours with an air temperature higher than 33.9°F or 35.9°F; perhaps the number of these occasions will be approximately counter-balanced by the number of occasions when outdoor building work is able to proceed even though the air temperature is below 33.9°F or 35.9°F.

The figures in Tables 2M, 2N and 2O relate to a 7-day working week and not to a 5-day working week.

A Table for Converting Temperatures in degrees Fahrenheit to degrees Centigrade is given at Table 2P.

TABLE 2

AVERAGES OF DAILY MAXIMUM, MINIMUM AND MEAN $\frac{1}{2}$ (MAX. + MIN.) TEMPERATURE
IN DEGREES FAHRENHEIT FOR TEMPERATURE RECORDING STATIONS IN THE
ABERDEEN AREA
30 YEARS PERIOD FROM 1931 TO 1960

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Year
<u>UDNY</u> (altitude 352 feet)													
Maximum	40.7	41.8	45.5	50.4	55.0	60.2	63.8	62.7	59.3	53.2	46.7	42.9	51.9
Minimum	30.4	31.0	33.5	36.7	40.8	45.3	49.4	48.4	45.7	41.1	36.5	33.1	39.3
Mean	35.5	36.4	39.5	43.5	47.9	52.7	56.6	55.5	52.5	47.1	41.6	38.0	45.6
<u>DYCE AIRPORT</u> (altitude 190 feet)													
Maximum	40.8	42.3	45.9	50.9	55.1	60.8	64.2	63.6	59.9	53.6	47.0	42.7	52.2
Minimum	31.7	32.0	34.2	37.0	41.3	46.4	50.2	49.3	46.2	42.1	37.2	34.5	40.2
Mean	36.3	37.1	40.1	43.9	48.2	53.6	57.2	56.4	53.0	47.8	42.1	38.6	46.2
<u>CRAIBSTONE</u> (altitude 300 feet)													
Maximum	41.1	42.0	45.6	50.3	54.8	60.6	63.7	62.9	59.3	53.1	46.9	43.1	51.9
Minimum	32.0	32.4	34.7	37.2	41.2	46.0	49.8	49.3	46.5	42.1	37.5	34.5	40.2
Mean	36.5	37.2	40.1	43.7	48.0	53.3	56.7	56.1	52.9	47.6	42.2	38.8	46.1
<u>MANNOFIELD RESERVOIR</u> (altitude 171 feet)													
Maximum	41.7	42.7	46.3	51.4	54.9	60.5	63.9	63.2	59.6	53.5	47.4	43.9	52.4
Minimum	31.7	31.9	35.1	37.9	42.1	47.1	50.9	50.3	46.9	42.5	37.1	34.4	40.7
Mean	36.7	37.3	40.7	44.6	48.5	53.8	57.4	56.7	53.2	48.0	42.3	39.1	46.5
<u>MUCHALLS</u> (Altitude 210 feet)													
Maximum	41.3	42.1	45.4	49.9	53.9	59.5	62.9	62.7	59.0	53.2	47.4	43.7	51.7
Minimum	32.4	32.9	35.3	37.6	41.6	46.4	50.5	50.1	47.3	42.8	38.3	34.9	40.8
Mean	36.9	37.5	40.3	43.7	47.7	52.9	56.7	56.4	53.1	48.0	42.9	39.3	46.3

Note:

The standard period for averages of daily maximum, minimum and mean temperatures in current use in the Meteorological Office is the 30 years period from 1931 to 1960. The averages quoted above for Craibstone are actual averages over this period of 30 years, but the averages quoted for the other locations have been estimated from shorter period or broken periods of records.

TABLE 2A

AVERAGES OF THE HIGHEST AND LOWEST TEMPERATURES IN EACH MONTH
IN DEGREES FAHRENHEIT FOR TEMPERATURE RECORDING STATIONS
IN THE ABERDEEN AREA

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Year
<u>DYCE AIRPORT</u> (altitude 190 feet) - 26 years from 1942 to 1944 and from 1946 to 1968													
Average of the Highest each Month	52	53	58	64	67	73	74	72	70	64	56	53	77*
Average of the Lowest each Month	15	18	21	26	31	37	39	37	35	29	22	19	11**
<u>CRAIBSTONE</u> (Altitude 300 feet) - 44 years from 1925 to 1968													
Average of the Highest each Month	51	52	57	62	65	73	73	72	69	63	56	52	76*
Average of the Lowest each Month	21	23	25	28	32	37	41	40	37	32	28	24	18**
<u>MANNOFIELD RESERVOIR</u> (altitude 171 feet) - 19 years from 1950 to 1968													
Average of the Highest each Month	51	52	57	62	65	72	73	71	69	63	55	52	76*
Average of the Lowest each Month	19	20	25	27	33	38	41	39	37	32	25	22	15**
<u>MUCHALLS</u> (altitude 210 feet) - 15 years from 1951 to 1965													
Average of the Highest each Month	50	52	56	60	64	70	72	70	68	62	54	51	75*
Average of the Lowest each Month	23	24	27	31	33	38	42	41	39	34	29	26	21**

* = Average of the Highest each year
** = Average of the Lowest each year

TABLE 2B

ABSOLUTE HIGHEST AND LOWEST TEMPERATURES IN DEGREES FAHRENHEIT
RECORDED IN EACH MONTH AT TEMPERATURE RECORDING
STATIONS IN THE ABERDEEN AREA

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Year
<u>DYCE AIRPORT</u> (altitude 190 feet) - 26 years from 1942 to 1944 and from 1946 to 1968													
Absolute Highest in each Month	56	61	69	71	74	84	83	81	78	71	62	57	84*
Absolute Lowest in each Month	-2	-5	0	20	25	32	32	32	27	21	11	8	-5**
<u>GRAIBSTONE</u> (altitude 300 feet) - 44 years from 1925 to 1968													
Absolute Highest in each Month	56	61	68	70	73	84	81	80	77	73	63	60	84*
Absolute Lowest in each Month	10	13	11	20	28	33	35	35	27	26	18	12	10**
<u>MANNOFIELD RESERVOIR</u> (altitude 171 feet) - 19 years from 1950 to 1968													
Absolute Highest in each Month	58	60	68	70	72	83	82	81	77	70	59	57	83*
Absolute Lowest in each Month	11	5	9	21	28	33	35	35	30	28	18	15	5**
<u>MUCHALLS</u> (altitude 210 feet) - 15 years from 1951 to 1965													
Absolute Highest in each Month	56	58	68	69	70	78	80	81	78	68	58	56	81*
Absolute Lowest in each Month	15	16	17	28	31	35	40	38	32	30	23	18	15**

* = Absolute Highest during Whole Period
** = Absolute Lowest during Whole Period

TABLE 2C

STATISTICS OF MONTHLY AND ANNUAL MEAN $\frac{T}{2}$ (MAX + MIN) TEMPERATURES IN
DEGREES FAHRENHEIT FOR CRAIBSTONE NEAR ABERDEEN
(PERIOD OF RECORD = 44 YEARS FROM 1925 TO 1968)

STATISTICS OF MONTHLY MEAN TEMPERATURES

Month	Highest Monthly Mean F	Monthly Mean Seldom* Above F	Median† F	Monthly Mean Seldom* Below F	Lowest Monthly Mean F
January	41.3 in January 1932	39.3	36.8	34.7	30.9 in January 1945
February	42.0 in February 1943	40.0	37.5	34.9	29.6 in February 1947
March	47.8 in March 1938	43.2	40.1	37.7	32.7 in March 1947
April	46.9 in April 1943, 1946 and 1949	45.3	43.5	41.7	39.9 in April 1966
May	51.2 in May 1960	48.9	47.7	46.0	44.0 in May 1968
June	56.8 in June 1940	54.3	53.3	52.1	48.7 in June 1927
July	60.5 in July 1933	57.7	56.1	55.2	51.0 in July 1965
August	60.3 in August 1947	57.1	55.9	54.3	51.7 in August 1956
September	56.2 in September 1949	54.7	52.9	51.1	48.3 in September 1952
October	51.3 in October 1959	49.0	47.5	46.3	42.8 in October 1926
November	44.9 in November 1945	43.3	41.5	40.5	37.7 in November 1925 and 1965
December	42.9 in December 1934	40.5	38.4	36.4	33.4 in December 1950

Statistics of Annual Mean Temperatures

Period of Record	Highest Annual Mean F	Annual Mean Seldom* Above F	Median† F	Annual Mean Seldom* Below F	Lowest Annual Mean F
44 years	47.6 in 1959	46.6	45.7	45.1	44.8 in 1962, 1963 and 1965

*Seldom = 20 per cent of occasions or 1 year in 5; the figures given are the upper and lower quintiles.

†Median = the "middle" value, i.e. half the mean temperatures exceed it and half fall below it.

TABLE 2D

STATISTICS OF MONTHLY MAXIMUM TEMPERATURES IN DEGREES FAHRENHEIT FOR
CRAIBSTONE NEAR ABERDEEN
(PERIOD OF RECORD = 44 YEARS FROM 1925 TO 1968)

Statistics of Monthly Maximum Temperatures

Month	Highest Monthly Maximum Temperature	Monthly Maximum Temperature Seldom* Above	Median ⁺	Monthly Maximum Temperature Seldom* Below	Lowest Monthly Maximum Temperature
January	56°F in January 1932, 1938, 1944 and 1953	55°F	51°F	49°F	41°F in January 1963
February	61°F in February 1939	56°F	53°F	48°F	35°F in February 1947
March	68°F in March 1929 and 1953	62°F	57°F	52°F	44°F in March 1947
April	70°F in April 1942 and 1946	65°F	62°F	58°F	53°F in April 1932
May	73°F in May 1939	68°F	65°F	62°F	60°F in May 1946, 1967 and 1968
June	84°F in June 1939	76°F	73°F	69°F	63°F in June 1927
July	81°F in July 1933	77°F	73°F	70°F	62°F in July 1965
August	80°F in August 1933	75°F	71°F	69°F	65°F in August 1956 and 1962
September	77°F in September 1953	72°F	68°F	66°F	62°F in September 1957
October	73°F in October 1926	67°F	63°F	60°F	54°F in October 1932
November	63°F in November 1947	58°F	55°F	53°F	50°F in November 1966
December	60°F in December 1931	55°F	52°F	48°F	45°F in December 1935

*Seldom = 20 per cent of occasions or 1 year in 5;
the figures given are the upper and lower
quintiles.

⁺ Median = the "middle" value, i.e. half the maximum
temperatures exceed it and half fall below
it.

TABLE 2E

STATISTICS OF MONTHLY MINIMUM TEMPERATURES IN DEGREES FAHRENHEIT FOR
CRAIBSTONE NEAR ABERDEEN
(PERIOD OF RECORD = 44 YEARS FROM 1925 TO 1968)

Statistics of Monthly Minimum Temperatures

Month	<u>Highest</u> <u>Monthly</u> <u>Minimum</u> <u>Temperature</u>	<u>Monthly</u> <u>Minimum</u> <u>Temperature</u> <u>Seldom*</u> <u>Above</u>	<u>Median</u> [†]	<u>Monthly</u> <u>Minimum</u> <u>Temperature</u> <u>Seldom*</u> <u>Below</u>	<u>Lowest</u> <u>Monthly</u> <u>Minimum</u> <u>Temperature</u>
January	29°F in January 1930 and 1934	27°F	22°F	16°F	10°F in January 1945
February	30°F in February 1943 and 1967	27°F	25°F	17°F	13°F in February 1947
March	32°F in March 1957 and 1959	29°F	27°F	22°F	11°F in March 1958
April	33°F in April 1926	31°F	29°F	26°F	20°F in April 1968
May	38°F in May 1964	34°F	32°F	30°F	28°F in May 1942
June	44°F in June 1966	40°F	37°F	35°F	33°F in June 1952
July	47°F in July 1925	44°F	41°F	40°F	35°F in July 1965
August	46°F in August 1959	42°F	41°F	38°F	35°F in August 1954
September	43°F in September 1930	40°F	38°F	35°F	27°F in September 1944
October	38°F in October 1963	34°F	33°F	30°F	26°F in October 1926
November	35°F in November 1931	30°F	28°F	25°F	18°F in November 1947
December	33°F in December 1934	28°F	25°F	20°F	12°F in December 1937

*Seldom = 20 per cent of occasions or 1 year in 5;
the figures given are the upper and lower
quintiles.

†Median = the "middle" value, i.e. half the minimum
temperatures exceed it and half fall below
it.

TABLE 2F

STATISTICS OF ANNUAL MAXIMUM AND MINIMUM TEMPERATURES IN DEGREES FAHRENHEIT FOR TEMPERATURE RECORDING STATIONS
IN THE ABERDEEN AREA

Station	Period of Record	Annual Maximum Temperatures °F					Annual Minimum Temperatures °F				
		Highest	Seldom* Above	Median†	Seldom* Below	Lowest	Lowest	Seldom* Below	Median†	Highest	
<u>DYCE AIRPORT</u> (Altitude 190 feet)	26 years	84	80	76	73	71	-5	7	13	20	
<u>CRAIBSTONE</u> (Altitude 300 feet)	44 years	84	78	76	73	70	10	15	17	27	
<u>MANNOFIELD RESERVOIR</u> (altitude 171 feet)	19 years	83	79	76	74	70	5	11	16	22	

*Seldom = 20 per cent of occasions or 1 year in 5; the figures given are the upper and lower quintiles.

†Median = the "middle" value, i.e. half the temperatures exceed it and half fall below it.

TABLE 2G

PERCENTAGE NUMBER OF OCCASIONS WITH AIR TEMPERATURES AT OR BELOW CERTAIN LIMITS
AT 0000, 0300, 0600, 0900, 1200, 1500, 1800 AND 2100 HOURS GMT CALCULATED
FROM READINGS MADE AT DYCE (ABERDEEN) AIRPORT DURING THE 12 YEARS
FROM 1957 TO 1968

Month	Hour GMT	0°C (32.0°F) or less	4°C (39.2°F) or less	8°C (46.4°F) or less	12°C (53.6°F) or less	16°C (60.8°F) or less	20°C (68.0°F) or less
		%	%	%	%	%	%
JANUARY	0000	27	74	97	99	100	100
	0300	28	74	98	100	100	100
	0600	25	75	97	100	100	100
	0900	24	75	97	100	100	100
	1200	15	59	94	100	100	100
	1500	12	58	94	100	100	100
	1800	21	70	96	100	100	100
	2100	24	73	96	100	100	100
FEBRUARY	0000	26	70	96	100	100	100
	0300	26	71	96	100	100	100
	0600	26	72	96	100	100	100
	0900	23	68	95	100	100	100
	1200	10	43	85	99	100	100
	1500	6	43	83	99	100	100
	1800	18	61	92	100	100	100
	2100	24	68	96	100	100	100
MARCH	0000	12	57	93	99	100	100
	0300	14	61	93	100	100	100
	0600	17	63	94	100	100	100
	0900	8	42	87	99	100	100
	1200	4	22	67	94	99	100
	1500	2	23	66	92	99	100
	1800	6	33	83	98	100	100
	2100	10	53	91	99	100	100
APRIL	0000	9	43	86	99	100	100
	0300	12	46	89	99	100	100
	0600	13	44	90	100	100	100
	0900	1	17	61	94	100	100
	1200	0	8	43	80	98	100
	1500	0	7	41	78	97	100
	1800	0	10	54	92	99	100
	2100	4	30	82	99	100	100

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TABLE 2G (CONT'D)

PERCENTAGE NUMBER OF OCCASIONS WITH AIR TEMPERATURES AT OR BELOW CERTAIN LIMITS
AT 0000, 0300, 0600, 0900, 1200, 1500, 1800 AND 2100 HOURS GMT CALCULATED
FROM READINGS MADE AT DYCE (ABERDEEN) AIRPORT DURING THE 12 YEARS
FROM 1957 TO 1968

Month	Hour GMT	0°C (32.0°F) or less	4°C (39.2°F) or less	8°C (46.4°F) or less	12°C (53.6°F) or less	16°C (60.8°F) or less	20°C (68.0°F) or less
		%	%	%	%	%	%
MAY	0000	0	17	72	99	100	100
	0300	3	23	78	100	100	100
	0600	1	12	69	98	100	100
	0900	0	2	27	82	99	100
	1200	0	0	14	63	93	99
	1500	0	0	17	61	93	99
	1800	0	0	25	79	97	100
	2100	0	6	52	96	100	100
JUNE	0000	0	2	23	85	99	100
	0300	0	4	32	92	99	100
	0600	0	1	11	77	99	100
	0900	0	0	1	33	83	100
	1200	0	0	1	20	67	96
	1500	0	0	1	17	65	95
	1800	0	0	1	29	83	98
	2100	0	0	6	60	97	100
JULY	0000	0	1	11	69	98	100
	0300	0	2	17	77	99	100
	0600	0	1	6	65	97	100
	0900	0	0	0	27	82	100
	1200	0	0	0	12	63	94
	1500	0	0	0	11	64	93
	1800	0	0	0	20	77	99
	2100	0	0	1	48	95	100
AUGUST	0000	0	0	11	69	98	100
	0300	0	2	19	73	99	100
	0600	0	1	13	68	99	100
	0900	0	0	0	23	87	99
	1200	0	0	0	7	64	96
	1500	0	0	0	7	66	93
	1800	0	0	0	15	80	98
	2100	0	0	3	52	97	100

TABLE 2G (CONT'D)

Month	Hour GMT	0°C (32.0°F) or less	4°C (39.2°F) or less	8°C (46.4°F) or less	12°C (53.6°F) or less	16°C (60.8°F) or less	20°C (68.0°F) or less
		%	%	%	%	%	%
SEPTEMBER	0000	0	2	19	73	99	100
	0300	0	3	27	79	100	100
	0600	0	5	28	81	100	100
	0900	0	0	2	46	96	100
	1200	0	0	0	19	76	98
	1500	0	0	0	18	78	98
	1800	0	0	2	42	93	100
	2100	0	1	13	67	100	100
OCTOBER	0000	1	11	47	90	100	100
	0300	1	15	48	92	100	100
	0600	1	14	52	94	100	100
	0900	0	5	31	85	100	100
	1200	0	1	8	60	97	100
	1500	0	1	9	60	96	100
	1800	0	4	31	82	100	100
	2100	1	8	42	89	100	100
NOVEMBER	0000	12	43	79	99	100	100
	0300	13	44	81	100	100	100
	0600	13	46	82	100	100	100
	0900	12	41	81	99	100	100
	1200	6	19	64	97	100	100
	1500	2	18	67	99	100	100
	1800	8	36	79	100	100	100
	2100	10	42	81	99	100	100
DECEMBER	0000	21	66	93	99	100	100
	0300	24	69	94	100	100	100
	0600	24	68	96	100	100	100
	0900	21	70	96	100	100	100
	1200	10	53	93	100	100	100
	1500	10	52	93	100	100	100
	1800	17	62	95	100	100	100
	2100	20	64	95	100	100	100

Example:- At 0600 hours GMT in December during the 12 years from 1957 to 1968, air temperatures were at or below 4 degrees Centigrade (39.2 F) on 68 per cent of occasions.

TABLE 2H

NUMBER OF DAYS WITH MAXIMUM AIR TEMPERATURES REACHING OR EXCEEDING
 60°F, 65°F, 70°F, 75°F and 80°F AT MANNOFIELD RESERVOIR, ABERDEEN
 (10 YEARS FROM 1959 TO 1968)

Year	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Year Total
<u>Number of Days with Maximum Air Temperatures Reaching or Exceeding 60°F</u>													
1959			1	0	6	16	28	30	22	6			109
1960				1	12	26	25	22	11				97
1961			4	3	4	17	20	26	16	4			94
1962				1	4	21	11	20	4	6			67
1963				3	2	13	15	12	9	3			57
1964				2	9	20	25	18	10	2			86
1965			2	1	3	16	3	22	8	1			56
1966				1	8	18	27	13	20	1			88
1967			2	4	2	20	28	21	14	2			93
1968				5	0	20	14	19	11	5			74
10 year average	0	0	1	2	5	19	20	20	13	3	0	0	83

<u>Number of Days with Maximum Air Temperatures Reaching or Exceeding 65°F</u>													
1959					2	6	18	18	9	3			56
1960					7	12	7	9	3				38
1961						9	5	9	7				30
1962				1		9	5	2	1				18
1963						3	4	3	4				14
1964					1	11	13	7	2				34
1965			1	0	2	7	0	6	1				17
1966				1	1	6	11	3	6				28
1967				2	0	9	21	9					41
1968						5	2	6	1	1			15
10 year average	0	0	<1	<1	1	8	9	7	3	<1	0	0	29

<u>Number of Days with Maximum Air Temperatures Reaching or Exceeding 70°F</u>													
1959						3	9	7	5	1			25
1960					1	6	1	1	1				10
1961						5	1	2					8
1962						1							1
1963								1	1				2
1964							6	3					9
1965					1	1							2
1966							3	1					4
1967				1	0	0	4	3					8
1968								1					1
10 year average	0	0	0	<1	<1	2	2	2	1	<1	0	0	7

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TABLE 2H (CONT'D)

NUMBER OF DAYS WITH MAXIMUM AIR TEMPERATURES REACHING OR EXCEEDING
60°F, 65°F, 70°F, 75°F and 80°F AT MANNOFIELD RESERVOIR, ABERDEEN
(10 YEARS FROM 1959 TO 1968)

Year	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Year Total
<u>Number of Days with Maximum Air Temperatures Reaching or Exceeding 75°F</u>													
1959						1	1	3	1				6
1960						1							1
1961							1						1
1962													0
1963													0
1964							1	1					2
1965													0
1966													0
1967													0
1968													0
10 year average	0	0	0	0	0	<1	<1	<1	<1	0	0	0	1

Note :

During the 10 years from 1959 to 1968 there were only 2 days at Mannofield Reservoir with maximum air temperatures reaching or exceeding 80°F viz.

80°F on 14 June 1959

81°F on 25 August 1959.

TABLE 2I

HIGHEST VALUES OF DRY AND WET BULB TEMPERATURE IN DEGREES FAHRENHEIT RECORDED
AT 0000, 0300, 0600, 0900, 1200, 1500, 1800 AND 2100 HOURS GMT DURING
THE 12 YEARS FROM 1957 TO 1968 AT DYCE (ABERDEEN) AIRPORT

Hour - GMT	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Year
Highest Values of Dry Bulb Temperature °F													
0000	55	54	55	57	59	63	64	70	63	59	55	55	70
0300	54	54	54	55	54	63	63	68	59	57	54	54	68
0600	52	52	55	54	57	64	66	68	61	59	54	55	68
0900	52	52	57	61	64	70	73	77	68	61	55	52	77
1200	54	59	66	66	73	79	77	79	75	68	57	55	79
1500	55	57	68	70	73	81	81	81	75	72	57	55	81
1800	54	50	61	66	68	73	77	73	68	63	55	54	77
2100	55	52	55	57	63	66	66	68	61	59	55	55	68
Absolute Highest	55	59	68	70	73	81	81	81	75	72	57	55	81

Hour - GMT	Highest Values of Wet Bulb Temperature °F												
0000	48	48	50	52	59	61	61	64	59	57	54	50	64
0300	48	48	50	52	54	59	59	63	59	57	54	52	63
0600	50	50	50	50	54	59	61	64	59	57	52	50	64
0900	48	50	52	55	59	66	64	68	63	57	52	48	68
1200	50	54	55	57	61	68	68	68	64	63	54	50	68
1500	50	54	55	57	63	64	72	68	63	63	54	50	72
1800	50	50	54	57	63	64	66	66	61	59	52	50	66
2100	54	48	52	54	59	63	63	64	59	57	54	50	64
Absolute Highest	54	54	55	57	63	68	72	68	64	63	54	52	72

NOTE

The 3-hourly values of highest wet bulb temperature at Dyce Airport (quoted above) compare reasonably well with hourly values of highest wet bulb temperature recorded at Turnhouse (Edinburgh) Airport and Kinloss in Morayshire. In general, the 3-hourly values at Dyce Airport are a degree or two Fahrenheit lower than the hourly values recorded at Edinburgh and Kinloss. This is to be expected because the actual highest readings may have occurred between the hours of observation. However, there is a large difference in September when the absolute highest wet bulb temperature of 64°F at Dyce Airport is 6°F lower than the absolute highest value of 70°F recorded at both Edinburgh and Kinloss. It is considered that if hourly records of wet bulb temperature were available from Dyce Airport, the absolute highest value of wet bulb temperature in September would be nearer 68°F than 64°F.

TABLE 2J

ACTUAL AND AVERAGE NUMBER OF DAYS OF AIR FROST (MINIMUM AIR TEMPERATURE
LESS THAN 32°F) AT TEMPERATURE RECORDING STATIONS
IN THE ABERDEEN AREA

Year	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Year Total
<u>DYCE AIRPORT</u> (altitude 190 feet) - 13 years from 1956 to 1968													
1956	19	22	5	12	1	2	0	0	0	2	8	7	78
1957	12	20	1	5	3	0	0	0	1	0	6	15	63
1958	24	21	21	7	4	0	0	0	0	1	10	14	102
1959	26	15	8	3	2	0	0	0	0	1	6	12	73
1960	17	21	8	3	2	0	0	0	0	0	8	19	78
1961	15	9	6	5	2	0	0	0	0	1	14	21	73
1962	14	11	17	7	1	0	0	0	0	3	12	19	84
1963	21	22	6	5	0	0	0	0	0	0	9	17	80
1964	9	10	6	3	0	1	0	0	1	4	13	17	64
1965	18	7	18	6	1	0	0	0	0	3	15	23	91
1966	13	14	7	13	1	0	0	0	0	5	8	15	76
1967	14	6	6	5	2	0	0	0	0	3	9	15	60
1968	16	22	9	12	5	0	0	0	0	0	6	8	78
13 year average	17	15	9	7	2	<1	0	0	<1	2	10	16	78
<u>CRAIBSTONE</u> (altitude 300 feet) - 13 years from 1956 to 1968													
1956	19	22	6	10	0	0	0	0	0	2	4	2	65
1957	11	13	1	4	3	0	0	0	0	0	3	12	47
1958	16	15	17	7	1	0	0	0	0	0	8	10	74
1959	24	10	1	1	2	0	0	0	0	0	3	5	46
1960	14	16	4	1	0	0	0	0	0	0	5	13	53
1961	12	6	3	4	1	0	0	0	0	0	10	19	55
1962	9	9	15	7	0	0	0	0	0	1	11	12	64
1963	23	23	5	3	0	0	0	0	0	0	5	11	70
1964	2	6	3	2	0	0	0	0	0	0	5	15	33
1965	16	8	11	2	0	0	0	0	0	0	12	12	61
1966	13	13	7	11	0	0	0	0	0	1	6	10	61
1967	9	2	3	5	1	0	0	0	0	1	5	12	38
1968	14	19	7	11	2	0	0	0	0	0	2	8	63
13 year average	14	13	6	5	1	0	0	0	0	<1	6	11	56

TABLE 2J (CONT'D)

ACTUAL AND AVERAGE NUMBER OF DAYS OF AIR FROST (MINIMUM AIR TEMPERATURE
LESS THAN 32°F) AT TEMPERATURE RECORDING STATIONS
IN THE ABERDEEN AREA

Year	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Year Total
<u>MANNOFIELD RESERVOIR</u> (altitude 171 feet) - 13 years from 1956 to 1968													
1956	21	21	4	10	0	0	0	0	0	2	4	3	65
1957	8	12	0	1	1	0	0	0	1	0	6	11	40
1958	16	16	16	6	1	0	0	0	0	1	9	12	77
1959	25	14	1	2	0	0	0	0	0	0	3	4	49
1960	15	18	3	1	1	0	0	0	0	0	9	16	63
1961	12	6	4	6	1	0	0	0	0	1	13	20	63
1962	10	10	14	6	1	0	0	0	0	1	12	13	67
1963	19	22	4	3	0	0	0	0	0	0	6	14	68
1964	6	10	2	1	0	0	0	0	0	1	7	18	45
1965	16	11	12	4	0	0	0	0	0	1	11	15	70
1966	12	14	6	11	0	0	0	0	0	2	9	12	66
1967	9	3	4	6	1	0	0	0	0	1	6	12	42
1968	14	19	7	10	2	0	0	0	0	0	1	10	63
13 year average	14	14	6	5	1	0	0	0	<1	1	7	12	60
<u>MUCHALLS</u> (altitude 210 feet) - 13 years from 1953 to 1965													
1953	10	10	7	9	0	0	0	0	0	0	1	0	37
1954	11	12	7	0	1	0	0	0	1	0	2	8	42
1955	13	24	15	0	2	0	0	0	0	3	1	10	68
1956	20	21	4	7	0	0	0	0	0	2	4	1	59
1957	9	15	0	2	4	0	0	0	0	1	2	13	46
1958	18	15	16	6	0	0	0	0	0	0	3	7	65
1959	25	10	1	1	1	0	0	0	0	0	4	4	46
1960	12	16	2	1	1	0	0	0	0	0	2	16	50
1961	12	4	3	2	0	0	0	0	0	0	6	19	46
1962	8	7	17	9	0	0	0	0	0	1	9	14	65
1963	20	21	4	0	0	0	0	0	0	0	3	6	54
1964	3	5	0	1	0	0	0	0	0	0	3	13	25
1965	16	6	11	0	0	0	0	0	0	0	12	11	56
13 year average	14	13	7	3	1	0	0	0	<1	1	4	9	52

TABLE 2K

AVERAGE AND EXTREME DATES OF FIRST AND LAST FROSTS AT TEMPERATURE

RECORDING STATIONS IN THE ABERDEEN AREA

	<u>Average Date of First Air Frost</u>	<u>Average Date of Last Air Frost</u>
Dyce Airport	21st October	18th May
Craibstone	4th November	28th April
Mannofield Reservoir	26th October	1st May
Muchalls	4th November	20th April

	<u>Earliest Date of First Air Frost</u>	<u>Latest Date of Last Air Frost</u>
Dyce Airport	25th September	16th June
Craibstone	5th October	30th May
Mannofield Reservoir	25th September	30th May
Muchalls	27th September	22nd May

Period of Records used to calculate Dates of First and Last Frosts

Dyce Airport	}	= 13 years from 1956 to 1968
Craibstone		
Mannofield Reservoir		
Muchalls		= 13 years from 1953 to 1965

TABLE 2L

AVERAGES AND EXTREMES OF SOIL TEMPERATURE IN DEGREES FAHRENHEIT FROM READINGS
MADE ONCE-DAILY AT 0900 HOURS GREENWICH MEAN TIME FROM A THERMOMETER EXPOSED
AT A DEPTH OF 4 INCHES BELOW A SURFACE OF BARE SOIL
AT CRAIBSTONE NEAR ABERDEEN - ALTITUDE 300 FEET

(Type of soil: light soil with hardpan beneath)

Actual Means of 0900 hours GMT Readings of 4-inch Soil Temperature recorded
in each month during the 10 years from 1959 to 1968

Year	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Year
1959	32.8	34.2	39.2	45.1	51.0	56.6	61.0	60.3	54.7	49.3	41.4	36.9	46.9
1960	35.2	35.4	38.0	44.0	52.0	57.9	56.7	55.8	51.6	47.3	39.5	34.8	45.7
1961	33.6	36.7	40.7	44.0	48.9	54.3	54.9	54.3	52.5	46.4	38.5	34.6	44.9
1962	33.9	34.8	34.0	40.0	47.4	53.7	53.5	52.7	50.8	46.1	39.3	34.9	43.4
1963	32.3	32.5	36.9	41.5	46.6	56.3	56.2	54.4	49.6	44.5	40.3	35.6	43.9
1964	35.6	35.9	36.7	43.1	51.7	55.9	57.7	55.6	51.1	44.1	38.5	34.0	45.0
1965	33.5	36.1	36.0	41.6	47.7	55.0	53.6	53.8	50.7	46.4	37.3	33.8	43.8
1966	34.3	34.2	37.4	38.1	48.0	55.5	56.5	53.9	52.5	45.1	37.2	34.1	43.9
1967	35.2	36.2	37.7	42.1	46.9	55.3	59.0	56.3	52.4	43.7	37.4	36.3	44.9
1968	34.5	32.6	37.2	41.3	46.0	57.3	55.9	56.7	52.7	47.0	39.6	37.0	44.8
10-year means	34.1	34.9	37.4	42.1	48.6	55.8	56.5	55.4	51.9	46.0	38.9	35.2	44.7

Absolute Highest 0900 hours GMT Readings of 4-inch Soil Temperature recorded
in each month during the 10 years from 1959 to 1968

Year	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Year
1959	35	44	43	54	58	63	68	67	60	55	48	41	68
1960	42	43	43	48	60	65	63	60	57	52	47	43	65
1961	39	43	47	50	54	59	59	59	57	54	45	41	59
1962	42	41	38	48	53	58	59	58	58	51	48	42	59
1963	33	33	40	49	53	61	61	64	55	51	49	42	64
1964	41	41	41	51	60	63	65	63	57	51	46	40	65
1965	38	41	43	46	54	60	59	57	55	53	46	40	60
1966	40	40	43	50	56	62	61	58	56	52	43	38	62
1967	40	42	44	51	54	62	63	61	57	51	45	42	63
1968	41	35	46	50	54	63	65	62	57	52	46	43	65
10-year means	39	40	43	50	56	62	62	61	57	52	46	41	63
10-year extremes	42	44	47	54	60	65	68	67	60	55	49	43	68

Absolute Lowest 0900 hours GMT Readings of 4-inch Soil Temperature recorded
in each month during the 10 years from 1959 to 1968

Year	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Year
1959	30	25	35	39	42	52	54	53	51	40	34	34	25
1960	33	33	34	40	42	52	53	51	47	42	33	32	32
1961	32	32	35	33	45	48	51	50	48	39	34	31	31
1962	32	33	32	33	43	45	50	50	46	36	34	33	32
1963	31	32	32	35	41	51	52	50	42	39	33	32	31
1964	33	33	33	35	45	50	52	49	44	34	33	32	32
1965	32	32	33	38	44	51	48	50	46	39	34	32	32
1966	32	31	33	33	43	51	51	50	48	37	33	32	31
1967	32	33	33	33	38	50	55	52	49	36	33	33	32
1968	32	32	33	33	41	53	51	51	47	40	35	33	32
10-year means	32	32	33	35	42	50	52	51	47	38	34	32	31
10-year extremes	30	25	32	33	38	45	48	49	42	34	33	31	25

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TABLE 2L (CONT'D)

AVERAGES AND EXTREMES OF EARTH TEMPERATURE IN DEGREES FAHRENHEIT FROM READINGS
MADE ONCE-DAILY AT 0900 HOURS GMT FROM THERMOMETERS EXPOSED AT DEPTHS
OF ONE FOOT AND FOUR FEET UNDER A SHORT GRASS-COVERED SURFACE AT
CRAIBSTONE NEAR ABERDEEN - ALTITUDE 300 FEET

(Type of soil: Light soil with hardpan beneath)

	<u>Jan</u>	<u>Feb</u>	<u>Mar</u>	<u>Apr</u>	<u>May</u>	<u>Jun</u>	<u>Jul</u>	<u>Aug</u>	<u>Sep</u>	<u>Oct</u>	<u>Nov</u>	<u>Dec</u>	<u>Year</u>
	<u>At 1 Foot (30 cm)</u>												
Monthly Mean of Daily Readings	36.7	36.5	38.8	43.0	48.6	54.1	57.7	57.6	54.1	48.7	43.0	39.0	46.6
Highest Monthly Mean of Daily Readings	39.6	39.0	43.2	45.3	51.3	57.7	60.6	61.0	57.0	51.8	46.9	42.6	61.0
Lowest Monthly Mean of Daily Readings	34.0	34.5	33.6	39.4	46.4	52.5	55.8	54.9	51.1	45.5	40.3	35.4	33.6
Absolute Highest Daily Reading	42.1	42.3	44.8	48.7	54.9	61.0	62.8	62.4	59.4	55.2	48.2	44.1	62.8
Absolute Lowest Daily Reading	32.7	33.4	32.7	35.4	40.6	48.0	51.3	52.5	46.4	37.9	36.1	34.0	32.7
	<u>At 4 Feet (122 cm)</u>												
Monthly Mean of Daily Readings	39.9	38.7	39.4	41.9	45.5	50.2	53.8	55.2	54.0	50.7	46.0	42.3	46.6
Highest Monthly Mean of Daily Readings	42.3	40.6	41.7	44.1	47.1	52.3	55.6	57.0	56.1	53.2	48.9	44.2	57.0
Lowest Monthly Mean of Daily Readings	37.6	37.0	36.7	39.2	43.2	48.6	52.3	53.8	52.0	48.4	44.2	39.9	36.7
Absolute Highest Daily Reading	43.7	41.0	43.0	45.3	49.6	54.3	57.4	57.9	57.9	55.2	50.7	46.2	57.9
Absolute Lowest Daily Reading	36.9	36.7	36.0	37.0	40.5	46.0	49.5	53.2	50.5	45.7	41.5	38.5	36.0

Notes : The mean temperatures quoted above have been obtained by averaging readings made during the 30 years period from 1931 to 1960 while the absolute highest and lowest readings relate to the 36 years period from 1925 to 1960.

The "Highest and Lowest Monthly Means of Daily Readings" relate to the single January, February, March etc. during the period from 1931 to 1960 which had the highest or lowest monthly mean of daily readings.

The "Absolute Highest and Lowest Daily Readings" are the absolute highest and lowest readings recorded during the period from 1925 to 1960.

TABLE 2M

TOTAL NUMBER OF DAYS IN EACH MONTH WITH AN HOURLY AIR TEMPERATURE READING OF
35.9 DEGREES FAHRENHEIT OR LESS (2.2 DEGREES CENTIGRADE OR LESS)
BETWEEN 0700 AND 1700 HOURS GREENWICH MEAN TIME
(8 AM AND 6 PM BRITISH STANDARD TIME)
AT DYCE (ABERDEEN) AIRPORT
(10 YEARS 1959 TO 1968)

Year	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Year Total
<u>Number of Days</u>													
1959	26	18	6	1	0	0	0	0	0	0	5	11	67
1960	18	20	8	0	0	0	0	0	0	0	7	18	71
1961	21	7	7	5	0	0	0	0	0	1	13	22	76
1962	16	19	21	7	0	0	0	0	0	3	13	15	94
1963	27	28	11	4	0	0	0	0	0	0	8	16	94
1964	14	11	8	3	0	0	0	0	1	8	12	20	77
1965	23	12	20	8	0	0	0	0	0	4	17	21	105
1966	19	16	13	11	0	0	0	0	0	4	12	20	95
1967	13	5	11	5	3	0	0	0	0	1	10	18	66
1968	21	25	15	12	2	0	0	0	0	1	7	10	93
10-year mean	19.8	16.1	12.0	5.6	0.5	0.0	0.0	0.0	0.1	2.2	10.4	17.1	83.8

TOTAL NUMBER OF HOURS BETWEEN 0700 AND 1700 HOURS GREENWICH MEAN TIME IN EACH MONTH
WITH AIR TEMPERATURES OF 35.9 DEGREES FAHRENHEIT OR LESS (2.2°C OR LESS)
AT DYCE (ABERDEEN) AIRPORT
(10 YEARS 1959 TO 1968)

Year	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Year Total
<u>Number of Hours</u>													
1959	218	94	11	1	0	0	0	0	0	0	13	55	392
1960	129	136	25	0	0	0	0	0	0	0	34	106	430
1961	110	35	17	10	0	0	0	0	0	2	61	167	402
1962	79	74	120	11	0	0	0	0	0	8	89	119	500
1963	233	245	22	8	0	0	0	0	0	0	41	105	654
1964	56	53	31	3	0	0	0	0	2	19	47	136	347
1965	156	58	93	9	0	0	0	0	0	6	107	144	573
1966	141	128	46	41	0	0	0	0	0	9	59	93	517
1967	103	16	22	10	4	0	0	0	0	3	35	132	325
1968	132	150	27	60	2	0	0	0	0	2	17	78	468
10-year mean	135.7	98.9	41.4	15.3	0.6	0.0	0.0	0.0	0.2	4.9	50.3	113.5	460.8
10-year mean expressed as percentage of total working time	44%	35%	13%	5%	<1%	0%	0%	0%	<1%	2%	17%	37%	13%

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TABLE 2N

TOTAL NUMBER OF DAYS IN EACH MONTH WITH AN HOURLY AIR TEMPERATURE READING OF
33.9 DEGREES FAHRENHEIT OR LESS (1.1 DEGREES CENTIGRADE OR LESS)
BETWEEN 0700 AND 1700 HOURS GREENWICH MEAN TIME
(8 AM AND 6 PM BRITISH STANDARD TIME)
AT DYCE (ABERDEEN) AIRPORT
(10 YEARS 1959 TO 1968)

Year	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Year Total
<u>Number of Days</u>													
1959	22	12	3	1	0	0	0	0	0	0	2	9	49
1960	15	19	4	0	0	0	0	0	0	0	5	13	56
1961	12	4	5	4	0	0	0	0	0	0	11	18	54
1962	11	10	14	5	0	0	0	0	0	3	10	12	65
1963	23	27	7	3	0	0	0	0	0	0	6	12	78
1964	7	8	5	2	0	0	0	0	1	5	8	16	52
1965	16	8	15	3	0	0	0	0	0	2	11	18	73
1966	13	13	6	11	0	0	0	0	0	3	7	10	63
1967	12	4	4	5	1	0	0	0	0	1	6	14	47
1968	17	21	6	9	0	0	0	0	0	1	3	8	65
10-year mean	14.8	12.6	6.9	4.3	0.1	0.0	0.0	0.0	0.1	1.5	6.9	13.0	60.2

TOTAL NUMBER OF HOURS BETWEEN 0700 AND 1700 GREENWICH MEAN TIME IN EACH MONTH
WITH AIR TEMPERATURES OF 33.9 DEGREES FAHRENHEIT OR LESS (1.1°C OR LESS)
AT DYCE (ABERDEEN) AIRPORT
(10 YEARS 1959 TO 1968)

Year	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Year Total
<u>Number of Hours</u>													
1959	162	45	4	1	0	0	0	0	0	0	9	29	250
1960	77	116	10	0	0	0	0	0	0	0	24	86	313
1961	49	20	10	6	0	0	0	0	0	0	37	136	258
1962	46	33	91	6	0	0	0	0	0	3	66	76	321
1963	170	168	13	3	0	0	0	0	0	0	26	75	455
1964	23	32	9	2	0	0	0	0	1	8	26	100	201
1965	103	29	61	3	0	0	0	0	0	3	80	85	364
1966	96	101	27	23	0	0	0	0	0	5	29	36	317
1967	49	9	8	6	1	0	0	0	0	2	19	95	189
1968	87	92	12	38	0	0	0	0	0	2	9	65	305
10-year mean	86.2	64.5	24.5	8.8	0.1	0.0	0.0	0.0	0.1	2.3	32.5	78.3	297.3
10-year mean expressed as percentage of total working time	28%	23%	8%	3%	<1%	0%	0%	0%	<1%	1%	11%	25%	8%

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TABLE 2.0

TOTAL NUMBER OF DAYS IN EACH MONTH WITH AN HOURLY AIR TEMPERATURE READING OF
31.9 DEGREES FAHRENHEIT OR LESS (MINUS 0.1 DEGREES CENTIGRADE OR LESS)
BETWEEN 0700 AND 1700 HOURS GREENWICH MEAN TIME
(8 AM AND 6 PM BRITISH STANDARD TIME)
AT DYCE (ABERDEEN) AIRPORT
(10 YEARS 1959 TO 1968)

Year	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Year Total
<u>Number of Days</u>													
1959	18	7	1	0	0	0	0	0	0	0	2	4	32
1960	6	14	3	0	0	0	0	0	0	0	3	7	33
1961	4	3	2	2	0	0	0	0	0	0	8	16	35
1962	5	3	11	3	0	0	0	0	0	0	7	8	37
1963	16	19	2	0	0	0	0	0	0	0	4	8	49
1964	3	6	2	1	0	0	0	0	0	2	7	11	32
1965	11	3	10	2	0	0	0	0	0	1	9	9	45
1966	9	10	5	7	0	0	0	0	0	1	4	6	42
1967	4	3	3	1	0	0	0	0	0	0	3	10	24
1968	10	12	3	6	0	0	0	0	0	0	2	7	40
10-year mean	8.6	8.0	4.2	2.2	0.0	0.0	0.0	0.0	0.0	0.4	4.9	8.6	36.9

TOTAL NUMBER OF HOURS BETWEEN 0700 AND 1700 HOURS GREENWICH MEAN TIME IN EACH MONTH
WITH AIR TEMPERATURES OF 31.9 DEGREES FAHRENHEIT OR LESS (MINUS 0.1°C OR LESS)
AT DYCE (ABERDEEN) AIRPORT
(10 YEARS 1959 TO 1968)

Year	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Year Total
<u>Number of Hours</u>													
1959	108	30	2	0	0	0	0	0	0	0	6	13	159
1960	34	99	7	0	0	0	0	0	0	0	14	45	199
1961	20	8	4	4	0	0	0	0	0	0	19	93	148
1962	30	5	57	4	0	0	0	0	0	0	32	37	165
1963	120	86	5	0	0	0	0	0	0	0	14	41	266
1964	14	16	3	1	0	0	0	0	0	2	16	48	100
1965	56	14	42	2	0	0	0	0	0	1	54	51	220
1966	56	47	11	9	0	0	0	0	0	3	11	19	156
1967	10	4	5	1	0	0	0	0	0	0	9	46	75
1968	61	43	4	16	0	0	0	0	0	0	3	43	170
10-year mean	50.9	35.2	14.0	3.7	0.0	0.0	0.0	0.0	0.0	0.6	17.8	43.6	165.8
10-year mean expressed as percentage of total working time	16%	12%	5%	1%	0%	0%	0%	0%	0%	<1%	6%	14%	5%

TABLE 2P

TABLE FOR CONVERTING DEGREES FAHRENHEIT TO DEGREES CENTIGRADE

<u>°F</u>	<u>°C</u>	<u>°F</u>	<u>°C</u>	<u>°F</u>	<u>°C</u>
0	minus 17.8	32	0.0	64	17.8
2	minus 16.7	34	1.1	66	18.9
4	minus 15.6	36	2.2	68	20.0
6	minus 14.4	38	3.3	70	21.1
8	minus 13.3	40	4.4	72	22.2
10	minus 12.2	42	5.6	74	23.3
12	minus 11.1	44	6.7	76	24.4
14	minus 10.0	46	7.8	78	25.6
16	minus 8.9	48	8.9	80	26.7
18	minus 7.8	50	10.0	82	27.8
20	minus 6.7	52	11.1	84	28.9
22	minus 5.6	54	12.2	86	30.0
24	minus 4.4	56	13.3	88	31.1
26	minus 3.3	58	14.4	90	32.2
28	minus 2.2	60	15.6	92	33.3
30	minus 1.1	62	16.7	94	34.4

3. RELATIVE HUMIDITY

In the Meteorological Office, values of relative humidity are obtained from simultaneous readings of dry and wet-bulb temperatures registered by thermometers exposed outdoors inside a ventilated thermometer screen at a height of four feet above ground level.

In the Aberdeen area as elsewhere in the British Isles the relative humidity reaches 90 per cent or thereabouts on most nights of the year. As an approximate rule, the highest values of relative humidity occur in association with the lowest air temperature of the day, i.e. usually around dawn while the lowest values of relative humidity occur in association with the highest air temperature of the day, i.e. usually in the middle of the afternoon. The main departures from this general rule occur in misty or foggy weather or when rain is falling.

In addition to the well marked diurnal range of relative humidity, there is also a change from season to season and the mean relative humidity is highest during the winter months and lowest in the spring and early summer.

During the summer in Aberdeen, high values of relative humidity are seldom associated with high values of air temperature and therefore "muggy" days with warm damp air are rare. On the other hand, during the winter and spring months, fresh winds from the North Sea on days with high relative humidities and low air temperatures bring a touch of "rawness" to the climate.

In the long term, there is unlikely to be any significant difference in relative humidity from place to place in the Aberdeen area or its environs although differences could exist at a particular time of day depending on the local weather prevailing at the time. For example, the direction and penetration of local sea breezes are factors which should be kept in mind, because the onset of a sea breeze, particularly during the spring and summer months, could lead to a marked drop in air temperature coinciding with a sharp rise in

relative humidity.

Depending on heating, ventilation and other factors, considerable differences can occur between the relative humidity indoors and the relative humidity outdoors.

Average Values of Relative Humidity and Dry Bulb Temperature on an 8-times per day basis are given in Table 3.

Percentage Frequencies of Occurrence of Relative Humidities at or within certain limits are given in Table 3A.

Statistics of Wet Bulb Temperature are included in the previous section of this report which deals with 'Temperature' i.e. section 2.

TABLE 3

AVERAGE VALUES OF RELATIVE HUMIDITY AND DRY BULB TEMPERATURE AT 0000 HOURS,
0300 HOURS, 0600 HOURS, 0900 HOURS, 1200 HOURS, 1500 HOURS, 1800 HOURS
AND 2100 HOURS GMT AT DYCE (ABERDEEN) AIRPORT
(10 YEARS 1959 TO 1968)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Year
<u>At 0000 hours GMT</u>													
Average R.H. per cent	86	85	85	87	88	87	88	90	89	88	86	86	87%
Average D.B. °F	35.2	36.1	38.3	40.3	43.9	49.8	51.4	51.4	50.4	46.6	40.1	36.9	43.4 °F
<u>At 0300 hours GMT</u>													
Average R.H. per cent	86	86	86	88	89	89	89	91	90	89	86	86	88%
Average D.B. °F	35.0	35.9	37.8	39.5	42.9	48.5	50.3	50.4	49.4	46.1	40.0	36.5	42.7 °F
<u>At 0600 hours GMT</u>													
Average R.H. per cent	86	86	86	88	87	86	88	90	91	89	87	86	87%
Average D.B. °F	35.1	35.8	37.4	39.6	44.6	51.1	52.0	51.1	48.9	45.9	39.6	36.3	43.1 °F
<u>At 0900 hours GMT</u>													
Average R.H. per cent	86	85	81	77	75	73	76	79	82	86	86	86	81%
Average D.B. °F	35.0	36.3	40.3	45.1	49.7	56.2	56.6	56.5	54.2	48.5	40.1	36.3	46.2 °F
<u>At 1200 hours GMT</u>													
Average R.H. per cent	82	79	73	69	70	69	70	72	72	78	80	83	75%
Average D.B. °F	37.8	40.1	44.1	48.0	52.3	58.8	59.4	59.5	57.7	52.3	43.7	38.7	49.4 °F
<u>At 1500 hours GMT</u>													
Average R.H. per cent	82	78	73	69	70	68	70	72	73	77	81	83	75%
Average D.B. °F	38.1	41.0	44.4	48.3	52.4	59.3	59.7	59.8	57.7	52.3	43.6	38.5	49.6 °F
<u>At 1800 hours GMT</u>													
Average R.H. per cent	85	84	79	75	74	73	75	78	81	85	85	86	80%
Average D.B. °F	36.0	37.8	41.7	45.9	50.4	56.8	57.6	57.4	54.5	48.6	41.0	37.0	47.1 °F
<u>At 2100 hours GMT</u>													
Average R.H. per cent	86	85	84	85	84	82	84	87	87	88	87	86	85%
Average D.B. °F	35.4	36.6	39.2	42.1	46.3	52.9	53.9	53.2	51.5	47.1	40.3	36.8	44.6 °F

R.H. = Relative humidity
D.B. = Dry Bulb Temperature

TABLE 3A

PERCENTAGE FREQUENCY OF OCCURRENCE OF RELATIVE HUMIDITIES AT OR WITHIN
STATED LIMITS AT 0300 HOURS, 0900 HOURS, 1500 HOURS AND 2100 HOURS
DYCE (ABERDEEN) AIRPORT (10 YEARS 1957 TO 1966)

Month	Hour GMT	Relative humidity											
		Less than 20%	20- 29%	30- 39%	40- 49%	50- 59%	60- 69%	70- 79%	80- 89%	90- 94%	95- 98%	99%	100%
JAN	0300	0.0	0.0	0.0	0.3	0.0	3.9	18.4	36.0	20.0	18.1	2.3	1.0
	0900	0.0	0.0	0.0	0.0	0.3	2.9	17.1	41.6	20.0	15.8	1.3	1.0
	1500	0.0	0.0	0.0	0.3	2.3	9.7	26.5	37.3	14.2	7.1	1.3	1.3
	2100	0.0	0.0	0.0	0.0	0.6	5.5	18.7	34.2	21.6	15.8	2.6	1.0
FEB	0300	0.0	0.0	0.0	0.0	0.7	6.7	14.2	32.0	22.7	17.7	2.8	3.2
	0900	0.0	0.0	0.0	0.0	1.4	3.5	17.7	35.9	24.1	13.5	2.1	1.8
	1500	0.0	0.0	0.0	0.4	5.3	19.5	27.6	24.5	11.3	8.5	1.8	1.1
	2100	0.0	0.0	0.0	0.0	0.0	5.3	16.3	35.1	24.5	14.9	1.8	2.1
MAR	0300	0.0	0.0	0.0	0.3	0.7	2.4	11.4	31.1	28.4	20.1	2.1	3.5
	0900	0.0	0.0	0.3	0.3	2.4	5.9	19.4	32.6	21.5	13.5	1.7	2.4
	1500	0.0	0.0	0.7	4.2	10.4	17.3	24.9	24.9	10.0	4.5	1.7	1.4
	2100	0.0	0.0	0.0	0.0	0.3	4.5	17.6	34.2	26.0	11.8	1.4	4.2
APR	0300	0.0	0.0	0.0	0.0	0.4	3.3	12.2	31.5	25.9	17.0	3.0	6.7
	0900	0.0	0.0	0.0	1.5	10.7	18.1	28.1	20.0	11.9	6.7	1.1	1.9
	1500	0.0	0.0	1.1	10.0	18.1	22.3	20.0	16.7	7.0	3.7	0.4	0.7
	2100	0.0	0.0	0.0	0.0	1.1	7.0	20.7	32.3	19.6	14.4	1.9	3.0
MAY	0300	0.0	0.0	0.0	0.0	0.4	2.5	9.5	33.6	20.8	20.1	4.6	8.5
	0900	0.0	0.0	0.0	3.5	9.5	26.7	23.6	19.0	8.5	6.0	2.1	1.1
	1500	0.0	0.0	1.8	5.3	19.0	26.0	23.2	13.7	8.1	1.1	1.1	0.7
	2100	0.0	0.0	0.0	0.0	1.4	5.3	26.8	35.5	19.4	7.0	2.5	2.1
JUNE	0300	0.0	0.0	0.0	0.0	0.0	2.2	11.1	26.7	26.3	18.5	5.9	9.3
	0900	0.0	0.0	0.4	3.0	9.6	25.9	30.4	17.4	5.2	6.3	1.1	0.7
	1500	0.0	0.0	1.5	7.4	16.7	29.2	22.2	13.7	5.2	1.9	0.7	1.5
	2100	0.0	0.0	0.0	0.4	4.1	8.1	21.1	34.5	15.2	11.1	3.3	2.2

(July to December overleaf)

TABLE 3A (Contd)

Month	Hour GMT	Relative Humidity											
		Less than 20%	20-29%	30-39%	40-49%	50-59%	60-69%	70-79%	80-89%	90-94%	95-98%	99%	100%
JULY	0300	0.0	0.0	0.0	0.0	0.0	1.8	6.8	25.1	25.1	26.9	6.1	8.2
	0900	0.0	0.0	0.0	0.4	5.0	22.9	26.9	17.6	15.1	5.7	3.2	3.2
	1500	0.0	0.0	0.7	5.0	13.3	22.9	25.5	17.9	4.7	7.5	1.4	1.1
	2100	0.0	0.0	0.0	0.0	1.4	2.5	18.3	38.1	18.6	14.0	3.2	3.9
AUG	0300	0.0	0.0	0.0	0.0	0.0	1.4	6.1	23.4	27.4	25.8	9.8	6.1
	0900	0.0	0.0	0.0	0.0	5.8	15.6	23.1	29.7	13.6	9.8	1.4	1.0
	1500	0.0	0.0	0.7	5.4	10.8	22.7	25.1	21.4	5.4	7.5	0.3	0.7
	2100	0.0	0.0	0.0	0.0	0.0	1.4	11.6	36.4	26.2	20.7	1.7	2.0
SEP	0300	0.0	0.0	0.0	0.0	0.0	1.0	9.3	29.7	25.0	27.3	3.0	4.7
	0900	0.0	0.0	0.0	0.0	2.7	12.3	26.3	33.3	13.7	10.0	0.7	1.0
	1500	0.0	0.0	0.7	3.7	14.7	21.7	24.2	20.0	9.7	4.3	0.3	0.7
	2100	0.0	0.0	0.0	0.0	0.7	3.0	13.7	32.9	28.7	18.0	2.0	1.0
OCT	0300	0.0	0.0	0.0	0.0	0.0	2.8	6.3	34.3	26.7	22.1	3.9	3.9
	0900	0.0	0.0	0.0	0.0	1.1	2.5	18.7	37.2	19.7	14.8	4.9	1.1
	1500	0.0	0.0	0.0	0.4	7.4	16.2	29.8	28.5	12.0	4.9	0.4	0.4
	2100	0.0	0.0	0.0	0.0	0.0	1.4	9.2	40.1	28.2	16.9	2.8	1.4
NOV	0300	0.0	0.0	0.0	0.0	0.7	3.4	9.5	38.2	25.8	19.0	1.7	1.7
	0900	0.0	0.0	0.0	0.0	1.0	3.7	12.9	34.3	25.1	18.6	3.4	1.0
	1500	0.0	0.0	0.0	0.0	1.7	9.5	25.4	35.6	19.3	7.5	1.0	0.0
	2100	0.0	0.0	0.0	0.3	0.0	3.4	10.5	37.7	26.1	18.6	1.4	2.0
DEC	0300	0.0	0.0	0.0	0.0	0.3	3.6	16.7	35.1	24.8	17.6	1.6	0.3
	0900	0.0	0.0	0.0	0.0	1.3	2.3	14.1	39.0	27.5	13.1	2.0	0.7
	1500	0.0	0.0	0.3	0.3	0.3	6.2	27.1	37.0	19.3	8.5	0.0	1.0
	2100	0.0	0.0	0.3	0.0	0.7	4.9	19.0	37.1	21.0	14.4	2.3	0.3

Example:

At 0300 hours GMT in December, relative humidities of between 80% and 89% occurred on 35.1 per cent of occasions.

4. SUNSHINE

In common with other places on the east coast of Scotland, Aberdeen has a good sunshine record especially when its northerly latitude is taken into account. For example, the annual average duration of sunshine for Mannofield Reservoir Aberdeen is 1,342 hours compared with the London districts of Kingsway and Regent's Park which have 1,359 hours and 1,353 hours per year respectively. There is a seasonal difference between Aberdeen and London in that Aberdeen has a longer duration of sunshine in the winter months but London has the better record during the summer.

Monthly Averages and Daily Mean Durations of Sunshine for recording stations in the Aberdeen area are given in Table 4.

All three sunshine recorder sites for which averages are quoted in Table 4 have relatively free horizons with no obstructing hills, buildings or trees (with an elevation exceeding about 3 degrees) to cut off the sunshine. Nevertheless, it can be seen that Mannofield Reservoir has on average about 60 hours per year less sunshine than Craibstone. The reason for this may be that Mannofield lies nearer to the main smoke producing areas of Aberdeen and atmospheric pollution may reduce the amount of sunshine, or that Mannofield is rather more prone to the incidence of sea fog (haar) than is Craibstone.

The reader will note from Table 4 that the average sunshine durations quoted for Dyce Airport have been obtained by comparing a sample of 19 years of recordings made at the Airport with recordings made during the same period of 19 years at Craibstone. The small difference of 30 hours per year between the average durations at Craibstone and Dyce Airport is not thought to have any special significance and may be due in part to certain shortcomings in the sample of years used for the comparison.

Statistics of Monthly and Annual Sunshine Durations for Craibstone based on recordings made during the 44 years from 1925 to 1968 are given in Table 4A.

Craibstone is the oldest established sunshine recording station in the Aberdeen area.

The path of the sun across the sky depends on the latitude and the time of year. Figure 2 is a solar chart for Aberdeen (latitude 57 degrees North) which shows the altitude and azimuth of the sun at various times of day, for the solstices, equinoxes and for certain intermediate dates. For a given site, the various obstructions can be plotted on the chart and their effect in cutting off the sun's radiation at various times can then be evaluated. For example, it can be seen from Figure 2 that at about 8.30 am on 23 August, the sun is at an altitude of 30 degrees with an azimuth of 115 degrees. It can also be seen that on 22 December, the maximum altitude of the sun is 10 degrees at 12 noon with an azimuth of 180 degrees. Thus, in midwinter, there would be no direct sunshine at any place in the Aberdeen area with a hill to the south whose top subtended an angle of 10 degrees or more.

TABLE 4

AVERAGES OF SUNSHINE DURATION IN HOURS - AVERAGE MONTHLY TOTALS
AND DAILY MEANS OVER 30 YEARS PERIOD FROM 1931 TO 1960 AT
SUNSHINE RECORDING STATIONS IN THE ABERDEEN AREA

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Year
<u>DYCE AIRPORT</u> - altitude 190 feet													
Monthly Total	54	80	107	146	179	178	155	146	127	95	59	44	1,370
Daily Mean	1.74	2.83	3.45	4.87	5.77	5.93	5.00	4.71	4.23	3.06	1.97	1.42	3.75
<u>CRAIBSTONE</u> - altitude 300 feet													
Monthly Total	56	81	109	148	182	183	159	149	130	97	60	47	1,401
Daily Mean	1.80	2.85	3.51	4.92	5.87	6.11	5.14	4.80	4.34	3.13	1.99	1.52	3.83
<u>MANNOFIELD RESERVOIR</u> - altitude 171 feet													
Monthly Total	51	75	103	144	177	179	154	144	127	93	54	41	1,342
Daily Mean	1.64	2.66	3.31	4.80	5.72	5.98	4.98	4.65	4.24	3.00	1.81	1.32	3.71

Note

The averages quoted above for Craibstone have been calculated from continuous recordings made throughout the entire period from 1931 to 1960 while the averages quoted for Dyce Airport have been estimated by comparing 19 years (1950 to 1968) of recordings made at Dyce Airport with recordings made during the same period at Craibstone. Tests at pairs of stations all with complete data suggest that differences of estimated from true values can be as large as 5%.

The averages quoted above for Mannofield Reservoir have been calculated from continuous recordings during the years from 1931 to 1947 and from 1951 to 1960. Values for the missing years from 1948 to 1950 have been computed by reference to the recordings made at Craibstone.

STATISTICS OF MONTHLY AND ANNUAL SUNSHINE DURATIONS IN HOURS FOR
CRAIBSTONE NEAR ABERDEEN
(PERIOD OF RECORD = 44 YEARS FROM 1925 to 1968)

Statistics of Monthly Sunshine Durations

<u>Month</u>	<u>Highest Monthly Sunshine Duration</u>	<u>Monthly Sunshine Duration Seldom* Above</u>	<u>Median†</u>	<u>Monthly Sunshine Duration Seldom* Below</u>	<u>Lowest Monthly Sunshine Duration</u>
January	91 hours in January 1959	69 hours	53 hours	42 hours	19 hours in January 1942
February	121 hours in February 1950	98 hours	79 hours	61 hours	39 hours in February 1947
March	173 hours in March 1933	134 hours	113 hours	85 hours	32 hours in March 1964
April	212 hours in April 1942	173 hours	145 hours	123 hours	85 hours in April 1941
May	238 hours in May 1948	206 hours	177 hours	142 hours	106 hours in May 1932
June	284 hours in June 1936	224 hours	189 hours	146 hours	101 hours in June 1966
July	260 hours in July 1955	190 hours	159 hours	116 hours	74 hours in July 1931
August	266 hours in August 1947	166 hours	145 hours	119 hours	80 hours in August 1963
September	175 hours in September 1959	148 hours	128 hours	100 hours	72 hours in September 1962
October	133 hours in October 1926 and 1958	115 hours	99 hours	85 hours	29 hours in October 1960
November	88 hours in November 1961	77 hours	63 hours	46 hours	23 hours in November 1941
December	72 hours in December 1951	57 hours	48 hours	34 hours	20 hours in December 1934

Statistics of Annual Sunshine Durations

<u>Period of record</u>	<u>Highest Annual Sunshine Duration</u>	<u>Annual Sunshine Duration Seldom* Above</u>	<u>Median†</u>	<u>Annual Sunshine Duration Seldom* Below</u>	<u>Lowest Annual Sunshine Duration</u>
44 years	1665 hours in 1955	1498 hours	1391 hours	1277 hours	1161 hours in 1932

*Seldom = 20 per cent of occasions or 1 year in 5: the figures given are the upper and lower quintiles.

†Median = the "middle" value, i.e. half the sunshine durations exceed it and half fall below it.

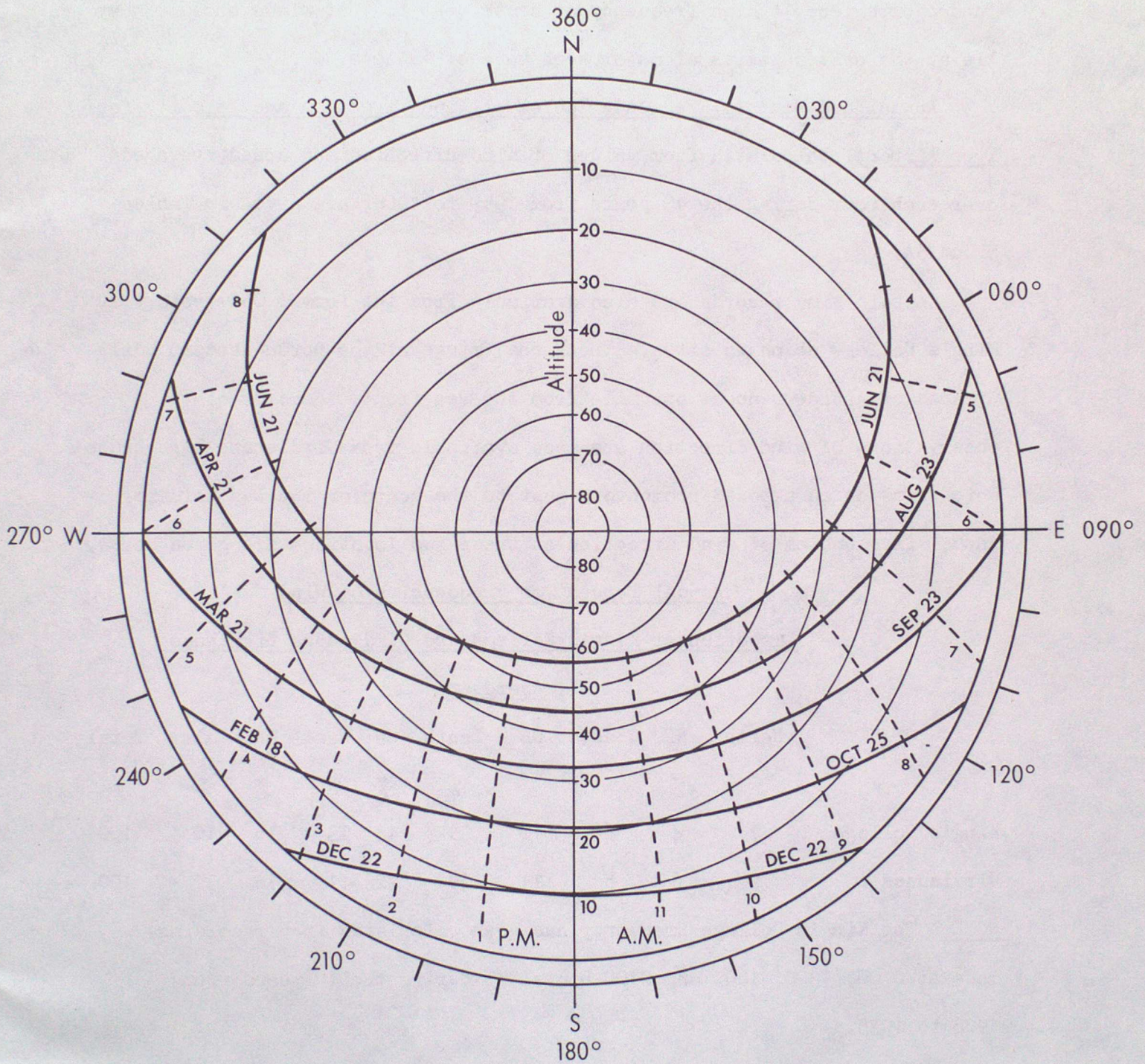


Fig2. SOLAR CHART FOR ABERDEEN Latitude 57°N

5. WINDS

Because of the marked sheltering influence of the high ground to the west of Aberdeen, wind directions with the highest frequency at Dyce (Aberdeen) Airport are north-west and south. In contrast, Edinburgh and Dundee experience a high frequency of south-west to west winds because they lie at the eastern exits of major west to east valleys.

Annual and Monthly Frequency Tables of Wind Direction and Velocity for Dyce Airport, calculated from values of wind direction and speed averaged over each hour during the 10 years from 1959 to 1968, are given in Tables 5 and 5A.

Certain wind records are also available from the former Observatory at King's College which is situated near the fringe of the north-eastern built-up area of Aberdeen about one mile from the sea front. Records of observations of wind direction are also available from Girdleness Lighthouse which lies on an exposed promontory just to the south of the Dee estuary. Annual frequencies of wind direction at these two locations are given below.

Annual Percentage Frequencies of Wind

Direction at King's College and Girdleness Lighthouse

	<u>Aberdeen</u>									
	North	NE	East	SE	South	SW	West	NW	Calm	Total
	%	%	%	%	%	%	%	%	%	%
King's College	7	4	6	10	21	13	13	16	10	100
Girdleness	9	6	5	11	16	22	11	18	2	100

NOTE The King's College frequency has been calculated from recordings made at 0700, 1300, 1800 and 2100 hours GMT during the 10 years from 1926 to 1935.

The Girdleness frequency has been calculated from observations made at 0300, 0900, 1500 and 2100 hours GMT during the 10 years from 1956 to 1965.

It should be noted that the frequencies of wind direction for King's College and Girdleness given above and the Dyce direction frequencies in Table 5 are based on different times of records in different periods of years. Nevertheless, it is interesting to compare the three separate frequency tables of wind direction in the 'average' year, bearing in mind that wind directions in the Dyce frequency table are grouped under 12 points of the compass while the frequencies for King's College and Girdleness are related to 8 points of the compass.

The sheltered nature of the site at King's College on the fringe of the built-up area is reflected in the large proportion of 'Calms' at this station in contrast to the relatively small proportion of 'Calms' at the more exposed coastal site of Girdleness Lighthouse. Otherwise, it can be seen that the three separate frequencies of wind direction have a great deal in common; the main differences occurring in the frequencies of winds from south, south-west and north-west.

Study of a topographic map of Aberdeen suggests that King's College is more open to winds from due south than Dyce Airport and this may account for the higher frequency of southerly winds at King's College. Other, possibly secondary, causes of the difference in the frequency of southerly winds may be local sea breeze effects or perhaps to the fact that the wind directions at King's College are grouped under 8 points of the compass while the directions at Dyce are related to 12 compass points. The valley of the Dee and the lie and orientation of the high ground and coast to the south of Aberdeen may account for the high frequency of south-westerly winds at Girdleness.

It is difficult to generalise about the winds in the built-up area of any city as the winds near the ground tend to follow the directions of the streets, being channelled up or down the streets between the buildings on either side and giving rise to gustiness at street intersections and corners.

The available evidence suggests that over the city of Aberdeen as a whole, the broad distribution of wind directions will be similar to the wind directions at Dyce Airport (see Tables 5 and 5A) although there is some justification for supposing that, unlike Dyce Airport, the frequency of winds over the city from a southerly point may be somewhat higher than the frequency of north-westerly winds.

The wind speed records for Dyce Airport suggest that at fairly open level sites in the Aberdeen area, the average wind speed near the ground is of the order of 10 mph ie similar to the average wind speed at comparable sites in London, Glasgow and Birmingham, but less than the average speeds at open level sites in Edinburgh. More important is the high frequency of strong gusts of wind and perhaps the most remarkable single feature of the wind regime in Aberdeen is the frequency of abnormally high gust speeds from the sector between north-west and north.

A Frequency Table showing the Speeds and Directions from which High Gusts of Wind blow at Dyce Airport is at Table 5B.

Extreme Wind Speeds

A statistical treatment of the highest hourly mean wind speeds (ie the highest wind speeds averaged over the 60 minutes between hours) and highest gusts recorded at Dyce Airport in each year during the 17 years from 1952 to 1968 yields the following results:

- A. Maximum Hourly Mean Wind Speeds at 33 feet (10 metres) above the ground likely to be exceeded on the average only once in the stated number of years:

<u>10 years</u>	<u>20 years</u>	<u>50 years</u>	<u>100 years</u>
54 mph	58 mph	64 mph	68 mph

- B. Maximum 3-second Gust Speeds at 33 feet (10 metres) above the ground likely to be exceeded on the average only once in the stated number of years:

<u>10 years</u>	<u>20 years</u>	<u>50 years</u>	<u>100 years</u>
89 mph	96 mph	106 mph	114 mph

This would seem an appropriate point at which to remind the reader of the meaning of the values at 'A' and 'B' above. For example, the maximum gust speed at 33 feet above the ground likely to be exceeded on the average only once in 50 years is often referred to as the "1 in 50 year gust" but is actually that gust which is likely to be exceeded with a probability of $0.02 = \frac{1}{50}$ (or a 2 per cent probability) in any one year. Similarly, the "1 in 100 year" maximum hourly mean speed is that speed likely to be exceeded with a probability of $0.01 = \frac{1}{100}$ (or a 1 per cent probability) in any one year.

When studying the extreme speeds at 'A' and 'B' above it should be borne in mind that during the period from January 1952 to March 1964, the site of the wind recording instrument at Dyce Airport was rather obstructed by trees, nearby hangars, airport buildings etc. From April 1964 onwards, the wind recording instrument has been sited in a relatively unobstructed location near the intersection of the airport runways. A comparison of the speeds recorded at the two sites reveals that the extreme speeds recorded at the 'new' unobstructed location are rather higher than those recorded at the former site nearer the airport buildings but insufficient records are available at the new site to consider recomputations of extreme speeds.

Maximum Wind Speeds for the Calculation of Wind Loadings on Buildings and Structures

The British Standards Institution Code of Practice CP3: Chapter V: Part 2: 1970 (15) recommends procedures for the calculation of wind loadings on buildings. Also, these are explained in Building Research Station Digest No.119 (8).

It can be seen from the Code (15) and BRS Digest (8) that the first step in the assessment of wind load is to estimate the value of the maximum 3-second gust speed likely to be exceeded on the average only once in 50 years at a height of 10 metres (33 feet) above ground level in open level country in the locality of the structure. The available evidence suggests that in the Aberdeen area this speed is 49 metres per second (110 mph). However, it is necessary to adjust this basic gust speed by using two factors (S_1 and S_2) which depend on the actual site and the nature and size of the building.

Topography Factor - S_1

This factor, described more fully on page 12 of the Code and in the Digest, takes account of the effect of topography on the exposure of the site. In general, the topography factor for the City of Aberdeen will be 1.0. However, on the outskirts of the City, a topography factor of 1.05 would be appropriate for structures to be erected near the tops of hills which rise abruptly from the general level of the terrain by 100 metres or more.

Ground Roughness, Building Size and Height above Ground Factor - S_2

It is also necessary to adjust the basic maximum gust speed by the S_2 factor which combines the effects of ground roughness, building size and the variation of wind speed with height. The ground roughness is dependent on the number and size of obstacles on the surface and may be described as 'smooth' in open level country, 'moderate' in country with windbreaks and scattered houses, 'rough' in woods, towns or the outskirts of cities and 'very rough' in the centre of large cities. Broadly speaking, it is a measure of the power of these obstacles to slow down the wind in the layers near the ground. However, before combining the S_2 factor with the basic gust speed of 49 metres per second, it should be realised that it takes a little time for the slowing-down process to take effect and that in Aberdeen, the transition from open country to built-up area is very abrupt - considerably more abrupt than for example in cities like London, Birmingham

and Manchester. Consequently, there is little doubt that strong winds on the outskirts of Aberdeen, particularly strong winds from the sector between north-west and north, are able to bring something like their full effect into the City.

The reader will notice from Table 3, page 15, of the Code that the S_2 factors for height and surface roughness have been classified under four categories of terrain numbered 1 to 4. Because of the 'open' nature of Aberdeen, it is considered that the S_2 factors quoted in the Code for 'city exposures' (viz Category 4 factors) are not applicable to Aberdeen and, in general, it is thought that Aberdeen and the districts immediately surrounding the City are more closely related to the height and surface roughness factors quoted in Categories 1 to 3 with the following classification of environment:

- Category 1 - Open fairly level country immediately outside the City boundary of Aberdeen.
- Category 2 - Districts on the outskirts of Aberdeen or on or near the fringe of the main built-up area.
- Category 3 - Parts of the City of Aberdeen in which the existing buildings are reasonably closely packed together.

The reader may wish to note that advice on design wind speeds, topographical effects etc can be given for a specific site and if there are any unusual features of local topography, exposure, or of the structure itself, advice on the appropriate gust speed and factors to be used should be sought from the Meteorological Office at 26 Palmerston Place, Edinburgh EH12 5AN quoting the National Grid Reference of the site in question.

Terms used by the Meteorological Office for describing the wind strength

<u>Term</u>	<u>Average speed near the ground</u>
Calm	less than 1 mph (less than 1 knot)
Light	1 to 12 mph (1 to 10 knots)
Moderate	13 to 18 mph (11 to 16 knots)

Fresh	19 to 24 mph (17 to 21 knots)
Strong	25 to 38 mph (22 to 33 knots)
Gale	39 to 46 mph (34 to 40 knots)
Severe Gale	Over 46 mph (over 40 knots)

The average speeds quoted above would be considerably exceeded in gusts. For example, in a gale, gusts of over 50 mph are common and may exceed 100 mph at exposed places in a severe gale. A gale warning is issued when the gusts are expected to reach 50 mph or more even if the average speed may be rather less than the limits shown in the above table.

As mentioned previously, the average duration of a high gust of wind is of the order of three seconds and such gusts are often responsible for the more common types of 'gale damage', eg the removal of roof tiles and chimney pots, blown-down fences and hoardings, damage to trees, crops and glass window panes etc.

The Aberdeen area escaped the worst effects of the very severe westerly gale of 15 January 1968 which caused considerable loss of life and enormous damage in the central belt of Scotland. For example, during the gale of 15 January 1968, the highest gust recorded at Dyce Airport was 66 mph compared with a highest recorded gust of 106 mph at Leuchars Airfield near St Andrews and a highest recorded gust of 104 mph at Turnhouse (Edinburgh) Airport.

The wind recording instrument at Dyce Airport was first brought into operation on 1 January 1952 and the most severe gale at Dyce Airport to date (ie up to 31 December 1969) occurred on 31 January 1953, ie the date of the disastrous North Sea floods which overtopped the sea defences along much of the English coast from Yorkshire to Kent and caused enormous damage to forests especially in the North of Scotland. The hourly mean wind speeds and gusts recorded at Dyce Airport during the gale of 31 January 1953 are given in Table 5C.

In the Aberdeen area, the most frequent and severe gales blow from the quadrant between west and north with a second highest frequency from the sector between south-south-east through south to south-south-west. Dyce Airport lies some distance inland from the coast and a gale from the quadrant between north and east is rather a rare event. However, there is little doubt that places on the coast of Aberdeenshire experience higher speeds than Dyce Airport when winds are blowing from easterly directions and at exposed places on or near the sea front of Aberdeen, easterly winds almost certainly reach gale force more often than they do at the Airport.

The number of Days of Gale at Dyce Airport during the 20 years from 1949 to 1968 are given in Table 5D. It is interesting to note from this Table that during the 20 years considered, no gales occurred in the months of June and July and that the highest frequency of gales occurred in the winter months of December, January and February.

The number of days and hours with Gusts to 39 mph or more and 55 mph or more during the 10 years from 1959 to 1968 are given in Tables 5E and 5F.

High Winds as a Factor interrupting Outdoor Building Work in the Aberdeen Area

Strong winds often lead to hazardous working conditions on building sites particularly at sites where men are working on ladders or have precarious hand and footholds above ground level. Perhaps equally dangerous are the risks to workmen who are handling materials which are likely to be snatched off or blown about by the wind.

With the increasing use of tower cranes in recent years, the incidence of strong winds has become an even more important factor affecting the time lost in building work, because when strong winds are blowing, the tower cranes have to cease operating, the hoisting of building materials is stopped and nearly all work may be brought to a standstill.

It is not possible to decide a precise threshold of wind speed above which work on a building site would be hampered or have to stop, because this will clearly depend on a number of factors including the exposure of the building site, eg whether it is sheltered from the wind by nearby buildings,

the height above ground level at which men are working, the type of work, the materials being used etc. Similar considerations would have to be taken into account in trying to assess the probable amount of time in which the use of a tower crane would be restricted or have to cease.

During a gale (average wind speed near the ground of 39 mph or more with frequent gusts to 50 mph or more) tower cranes cannot operate and probably most other types of outdoor building work would be brought to a standstill. However, a gale represents extreme wind conditions and high gusts of wind of say 40 mph or more associated with average speeds considerably less than 39 mph could also lead to dangerous working conditions and would also seriously restrict the use of tower cranes.

Records showing the incidence of gusts of 40 mph or more in each hour of the working part of the day are not readily available for the Aberdeen area. However, statistics of hourly mean wind speeds recorded at Dyce Airport are available for a fairly long period of years. A study of the hourly mean wind speeds and associated gust speeds recorded at Dyce Airport reveals that gusts of 40 mph or more first start to occur when the hourly mean wind speed reaches the level of about 20 mph and that gusts to 40 mph or more become quite frequent with hourly mean speeds of 25 mph or more. Accordingly, in view of the gusty nature of the winds in Aberdeen and the surrounding districts, statistics showing the incidence of hourly mean wind speeds of 25 mph or more should serve as a good indication of the incidence of fairly frequent gusts to 40 mph or more.

Table 5G gives the total number of days at Dyce Airport on which an hourly mean wind speed of 25 mph or more was recorded at any time between 0700 and 1700 hours Greenwich Mean Time (0800 and 1800 hours British Standard Time) during the 10 years from 1959 to 1968. Table 5G also gives the total number of hours in which hourly mean speeds of 25 mph or more when recorded between 0700 and 1700 hours GMT during the same 10-year period. It is

considered that for planning purposes the values given in Table 5G should provide a reasonably reliable guide to the probable amount of time in which outdoor work or the use of tower cranes might be hampered or have to cease at exposed places in the Aberdeen area.

It should be borne in mind when studying Table 5G that the hourly mean wind speeds of 25 mph or more were recorded at Dyce Airport at a height of 30 to 40 feet above ground level and that considerably higher speeds could be experienced at heights in excess of 40 feet above ground level, eg on exposed multi-storey buildings or high up on tower cranes. For example, an hourly mean speed of 25 mph or more with gusts to 40 mph or more at a height of 30 to 40 feet above ground level would become something like an hourly mean speed of 30 mph or more with gusts to 45 mph or more at a height of 150 feet above the ground at an exposed site in Aberdeen. When consulting Table 5G it should be noted that the figures relate to a 7-day working week and not to a 5-day working week.

A table for converting miles per hour to metres per second is at Table 5H.

TABLE 5

ANNUAL PERCENTAGE FREQUENCY OF WIND DIRECTION AND VELOCITY AT
DYCE (ABERDEEN) AIRPORT - (10 years 1959 to 1968)

Hourly Mean Wind Speed	Wind Directions in Degrees (True)												
	350- 10	20- 40	50- 70	80- 100	110- 130	140- 160	170- 190	200- 220	230- 250	260- 280	290- 310	320- 340	All Directions
0 mph	-	-	-	-	-	-	-	-	-	-	-	-	8.9%
1- 3 "	-	-	-	-	-	-	-	-	-	-	-	-	16.3%
4- 7 "	1.1	0.4	0.5	0.9	1.4	1.7	1.9	1.4	1.3	1.1	1.2	1.6	14.5%
8-12 "	1.3	0.4	0.6	1.0	1.8	2.7	3.5	2.4	2.6	2.3	3.1	2.7	24.4%
13-18 "	1.3	0.3	0.3	0.7	1.4	2.7	3.7	3.0	1.8	2.8	4.5	3.0	25.5%
19-24 "	0.3	0.1	0.1	0.1	0.4	0.6	1.0	1.1	0.4	0.8	1.5	1.0	7.4%
25-31 "	0.1	0+	0+	0+	0.1	0.2	0.4	0.3	0.2	0.3	0.4	0.4	2.4%
32-38 "	0+		0+		0+	0+	0.1	0.1	0+	0.1	0.1	0.1	0.5%
39-46 "	0+					0+	0+	0+		0+	0+	0+	0.1%
47-54 "											0+	0+	0+%
Total	4.1	1.2	1.5	2.7	5.1	7.9	10.6	8.3	6.3	7.4	10.8	8.8	100.0%

Notes

- The above frequencies have been calculated from values of wind direction and speed averaged over each hour during the 10 years from 1959 to 1968.
- Wind directions are measured in degrees from True North and relate to the direction from which the wind is blowing. For example :

Direction	360 degrees	=	wind blowing from	North
"	090	"	=	" " East
"	180	"	=	" " South
"	270	"	=	" " West
- Adding the columns of the above table vertically gives the percentage amount of time in the year with winds from the stated directions.
- Adding the columns of the above table horizontally gives the percentage amount of time in the year with winds in the stated speed ranges.

TABLE 5A

MONTHLY PERCENTAGE FREQUENCIES OF WIND DIRECTION AND VELOCITY AT
DYCE (ABERDEEN) AIRPORT
(10 YEARS FROM 1959 TO 1968)

Wind Direction in Degrees (True)													
Hourly Mean Wind Speed	350- 10	20- 40	50- 70	80- 100	110- 130	140- 160	170- 190	200- 220	230- 250	260- 280	290- 310	320- 340	All Directions
<u>JANUARY</u>													
Under 4 mph	-	-	-	-	-	-	-	-	-	-	-	-	24.6%
4-12 mph	2.7	0.8	1.0	1.7	1.6	2.6	4.7	3.2	3.5	3.8	5.0	4.4	35.0%
13-24 mph	0.5	0.1	0.3	1.2	2.2	3.7	4.3	3.9	2.4	5.3	9.9	2.7	36.5%
25-38 mph	0+	0+	0.1	0+	0.3	0.3	1.0	0.5	0.1	0.5	0.5	0.4	3.7%
39 mph or more						0+	0+			0+	0+		0.2%
Total	3.2	0.9	1.4	2.9	4.1	6.6	10.0	7.6	6.0	9.6	15.4	7.5	100.0%
<u>FEBRUARY</u>													
Under 4 mph	-	-	-	-	-	-	-	-	-	-	-	-	21.0%
4-12 mph	2.0	0.6	1.5	1.8	1.7	4.7	4.9	4.2	4.0	4.3	4.9	3.5	38.1%
13-24 mph	0.7	0.1	0.4	1.3	3.5	3.6	4.7	3.7	2.6	4.4	7.4	4.0	36.4%
25-38 mph	0+				0.2	0.3	0.7	0.5	0.2	0.8	0.8	0.7	4.2%
39 mph or more							0+	0+		0.1	0.1	0+	0.3%
Total	2.7	0.7	1.9	3.1	5.4	8.6	10.3	8.4	6.8	9.6	13.2	8.2	100.0%
<u>MARCH</u>													
Under 4 mph	-	-	-	-	-	-	-	-	-	-	-	-	18.3%
4-12 mph	2.0	0.9	1.1	1.3	3.1	4.5	4.7	3.3	3.9	2.7	4.0	2.6	34.1%
13-24 mph	1.1	0.2	0.1	0.3	3.4	5.8	7.0	5.4	3.7	5.1	7.1	3.2	42.4%
25-38 mph	0.2			0.1	0.3	0.2	0.1	0.8	0.5	0.9	1.1	0.9	5.1%
39 mph or more	0+							0+			0+	0+	0.1%
Total	3.3	1.1	1.2	1.7	6.8	10.5	11.8	9.5	8.1	8.7	12.2	6.7	100.0%
<u>APRIL</u>													
Under 4 mph	-	-	-	-	-	-	-	-	-	-	-	-	24.2%
4-12 mph	2.7	1.3	1.9	2.5	4.1	6.1	4.8	2.7	2.7	2.4	3.3	3.7	38.2%
13-24 mph	2.3	0.8	0.4	2.3	2.2	3.8	4.3	4.1	2.1	4.2	4.6	3.5	34.6%
25-38 mph	0.3			0+		0.2	0.3	0.1	0.2	0.5	0.7	0.5	2.8%
39 mph or more	0+									0+	0.1	0.1	0.2%
Total	5.3	2.1	2.3	4.8	6.3	10.1	9.4	6.9	5.0	7.1	8.7	7.8	100.0%

TABLE 5A (CONT'D)

MONTHLY PERCENTAGE FREQUENCIES OF WIND DIRECTION AND VELOCITY AT
DYCE (ABERDEEN) AIRPORT
(10 YEARS FROM 1959 TO 1968)

	Wind Direction in Degrees (True)												
Hourly Mean Wind Speed	350- 10	20- 40	50- 70	80- 100	110- 130	140- 160	170- 190	200- 220	230- 250	260- 280	290- 310	320- 340	All Directions
<u>MAY</u>													
Under 4 mph	-	-	-	-	-	-	-	-	-	-	-	-	25.5%
4-12 mph	3.7	1.1	1.0	2.9	5.4	4.7	3.8	2.5	2.5	2.4	3.1	4.4	37.5%
13-24 mph	3.6	0.6	0.4	0.9	3.1	3.9	4.3	2.9	1.4	1.6	4.3	7.2	34.2%
25-38 mph	0.1	0.1			0.2	0.3	0.5	0.1	0.5	0.1	0.4	0.4	2.7%
39 mph or more											0.1		0.1%
Total	7.4	1.8	1.4	3.8	8.7	8.9	8.6	5.5	4.4	4.1	7.9	12.0	100.0%
<u>JUNE</u>													
Under 4 mph	-	-	-	-	-	-	-	-	-	-	-	-	24.6%
4-12 mph	2.6	0.7	0.7	2.5	6.3	7.1	5.5	3.3	4.3	3.2	3.5	4.9	44.6%
13-24 mph	2.3	0.1	0.3	0.3	0.3	3.3	4.9	3.9	2.2	3.4	4.2	4.3	29.5%
25-38 mph	0.2						0.2	0.2	0.1	0.2	0.3	0.1	1.3%
39 mph or more													0.0%
Total	5.1	0.8	1.0	2.8	6.6	10.4	10.6	7.4	6.6	6.8	8.0	9.3	100.0%
<u>JULY</u>													
Under 4 mph	-	-	-	-	-	-	-	-	-	-	-	-	28.0%
4-12 mph	3.3	1.2	1.6	2.7	4.0	4.8	5.0	3.5	2.8	3.2	4.9	6.8	43.8%
13-24 mph	1.9	0.5	0.8	0.3	0.3	1.7	2.7	3.5	1.6	1.9	4.8	7.2	27.2%
25-38 mph	0+					0+	0.1	0.2	0.2	0.1	0.1	0.3	1.0%
39 mph or more													0.0%
Total	5.2	1.7	2.4	3.0	4.3	6.5	7.8	7.2	4.6	5.2	9.8	14.3	100.0%
<u>AUGUST</u>													
Under 4 mph	-	-	-	-	-	-	-	-	-	-	-	-	30.3%
4-12 mph	3.9	1.1	1.5	2.6	3.1	4.1	4.7	3.1	3.1	3.7	6.0	6.5	43.4%
13-24 mph	1.4	0.2	0.3	0.4	0.9	2.2	3.4	3.1	1.4	2.4	5.1	4.5	25.3%
25-38 mph						0+	0+	0.1	0.1	0.1	0.3	0.4	1.0%
39 mph or more													0.0%
Total	5.3	1.3	1.8	3.0	4.0	6.3	8.1	6.3	4.6	6.2	11.4	11.4	100.0%

TABLE 5A (CONT'D)

MONTHLY PERCENTAGE FREQUENCIES OF WIND DIRECTION AND VELOCITY AT
DYCE (ABERDEEN) AIRPORT
(10 YEARS FROM 1959 TO 1968)

Wind Direction in Degrees (True)													
Hourly Mean Wind Speed	350- 10	20- 40	50- 70	80- 100	110- 130	140- 160	170- 190	200- 220	230- 250	260- 280	290- 310	320- 340	All Directions
<u>SEPTEMBER</u>													
Under 4 mph	-	-	-	-	-	-	-	-	-	-	-	-	29.4%
4-12 mph	2.4	0.8	0.9	1.6	2.7	4.3	8.0	4.9	4.0	2.7	4.3	5.1	41.7%
13-24 mph	1.1	0.5	0.3	0.1	0.3	3.5	5.4	4.0	1.9	2.6	4.1	3.2	27.0%
25-38 mph	0.1				0+	0.1	0.3	0.3	0.2	0.4	0.3	0.2	1.9%
39 mph or more								0+					0+
Total	3.6	1.3	1.2	1.7	3.0	7.9	13.7	9.2	6.1	5.7	8.7	8.5	100.0%
<u>OCTOBER</u>													
Under 4 mph	-	-	-	-	-	-	-	-	-	-	-	-	25.3%
4-12 mph	0.6	0.3	1.5	1.7	3.2	4.7	8.0	5.7	5.1	3.0	3.3	2.1	39.2%
13-24 mph	1.5	0.3	0.1	0.7	1.3	4.0	5.3	6.6	2.6	3.2	4.0	2.3	31.9%
25-38 mph	0.3				0+	0.2	0.6	0.6	0.2	0.5	0.4	0.8	3.6%
39 mph or more												0+	0+
Total	2.4	0.6	1.6	2.4	4.5	8.9	13.9	12.9	7.9	6.7	7.7	5.2	100.0%
<u>NOVEMBER</u>													
Under 4 mph	-	-	-	-	-	-	-	-	-	-	-	-	26.1%
4-12 mph	1.7	0.4	0.6	1.6	2.2	2.5	5.6	4.7	5.4	4.7	4.9	3.7	38.0%
13-24 mph	2.3	0.4	0.7	2.0	2.1	2.7	4.6	3.6	1.8	3.7	5.4	3.3	32.6%
25-38 mph	0.1	0+		0.1	0.5	0.4	0.3	0.2	0+	0.3	0.6	0.6	3.1%
39 mph or more	0+										0.1	0.1	0.2%
Total	4.1	0.8	1.3	3.7	4.8	5.6	10.5	8.5	7.2	8.7	11.0	7.7	100.0%
<u>DECEMBER</u>													
Under 4 mph	-	-	-	-	-	-	-	-	-	-	-	-	23.9%
4-12 mph	1.0	0.2	0.4	0.5	1.2	2.1	6.3	4.2	5.2	4.2	4.9	3.9	34.1%
13-24 mph	1.1	0.2	0.1	0.6	1.5	1.9	5.3	4.5	2.8	5.9	11.2	3.3	38.4%
25-38 mph	0.1			0+	0.3	0.2	0.7	0.5	0.1	0.3	0.8	0.6	3.6%
39 mph or more											0+		0+
Total	2.2	0.4	0.5	1.1	3.0	4.2	12.3	9.2	8.1	10.4	16.9	7.8	100.0%

TABLE 5B

DIRECTIONS FROM WHICH HIGH GUSTS OF WIND BLOW AT THE METEOROLOGICAL OFFICE
AT DYCE (ABERDEEN) AIRPORT
(17 YEARS FROM 1952 TO 1968)

Speed of Gusts	Direction of Gusts Measured in Degrees from True North												Total
	350- 010	020- 040	050- 070	080- 100	110- 130	140- 160	170- 190	200- 220	230- 250	260- 280	290- 310	320- 340	
21 to 30 mph		1									1		2
31 to 40 mph	1		1	1	1	1	1	1	3	3	7	5	25
41 to 50 mph	7					4	12	7	6	4	12	20	72
51 to 60 mph	1		1		1	4	11	8	4	12	22	9	73
61 to 70 mph	3						3	4		3	7	2	22
71 to 80 mph	1										5	1	7
81 to 90 mph								1			1		2
91 to 100 mph													0
101 to 110 mph												1	1
Total	13	1	2	1	2	9	27	21	13	22	55	38	204
%Total	6	<1	1	<1	1	5	13	10	6	11	27	19	100%

Notes

1. The data used to calculate the above frequencies were the highest gusts (direction and speed) recorded at Dyce Airport in each month during the 17 years from 1952 to 1968 i.e. 17 years x 12 months = 204 highest monthly gusts.
2. The absolute highest gust recorded at Dyce Airport during the 17 years from 1952 to 1968 was 101 mph from direction 340 degrees on 31st January 1953 i.e. the date of the disastrous North Sea floods.

TABLE 5C

THE VERY SEVERE GALE OF 31 JANUARY 1953

HOURLY MEAN WIND DIRECTIONS AND SPEEDS AND SPEEDS OF HIGHEST GUSTS RECORDED AT THE METEOROLOGICAL OFFICE AT DYCE (ABERDEEN) AIRPORT ON 31 JANUARY 1953

<u>Hour - Greenwich Mean Time</u>				<u>Wind Direction</u> <u>averaged over</u> <u>60 minutes</u>	<u>Wind Speed</u> <u>averaged over</u> <u>60 minutes</u>	<u>Highest Gust</u> <u>during</u> <u>60 minutes</u>
Between 0000 and 0100 hours				From 250 degrees	9 mph	25 mph
"	0100	"	0200	" 250 "	11 mph	20 mph
"	0200	"	0300	" 270 "	22 mph	46 mph
"	0300	"	0400	" 280 "	31 mph	53 mph
"	0400	"	0500	" 290 "	35 mph	59 mph
"	0500	"	0600	" 290 "	38 mph	65 mph
"	0600	"	0700	" 300 "	41 mph	80 mph
"	0700	"	0800	" 300 "	51 mph	85 mph
"	0800	"	0900	" 300 "	47 mph	86 mph
"	0900	"	1000	" 310 "	45 mph	81 mph
"	1000	"	1100	" 330 "	52 mph	92 mph
"	1100	"	1200	" 340 "	63 mph	101 mph *
"	1200	"	1300	" 350 "	58 mph	93 mph
"	1300	"	1400	" 350 "	58 mph	94 mph
"	1400	"	1500	" 360 "	57 mph	96 mph
"	1500	"	1600	" 360 "	53 mph	93 mph
"	1600	"	1700	" 350 "	48 mph	83 mph
"	1700	"	1800	" 350 "	46 mph	81 mph **
"	1800	"	1900	" 350 "	40 mph	71 mph
"	1900	"	2000	" 350 "	38 mph	62 mph
"	2000	"	2100	" 350 "	39 mph	67 mph
"	2100	"	2200	" 350 "	35 mph	54 mph
"	2200	"	2300	" 350 "	30 mph	No record **
"	2300	"	2400	" 350 "	31 mph	57 mph

* The highest gust of 101 mph was recorded at 1130 hours GMT.

** Owing to a malfunction of the wind speed recording pen, there are certain gaps in the wind speed traces registered by the Dyce Airport anemograph during the two 60 minute periods between 1700 and 1800 hours GMT and between 2200 and 2300 hours GMT on 31 January 1953. Consequently there is no record of the highest gust between 2200 and 2300 hours GMT and the highest gust of 81 mph between 1700 and 1800 hours was noted from the dials of a separate "stand-by" wind recording instrument.

TABLE 5D

NUMBER OF DAYS WITH GALES DURING THE 20 YEARS FROM 1949 TO 1968 AT
DYCE (ABERDEEN) AIRPORT

<u>Year</u>	<u>Jan</u>	<u>Feb</u>	<u>Mar</u>	<u>Apr</u>	<u>May</u>	<u>Jun</u>	<u>Jul</u>	<u>Aug</u>	<u>Sep</u>	<u>Oct</u>	<u>Nov</u>	<u>Dec</u>	<u>Year Total</u>
1949	2	2	1	1	0	0	0	0	0	1	2	1	10
1950	1	3	2	4	0	0	0	1	4	1	0	1	17
1951	0	1	0	2	0	0	0	0	0	0	0	2	5
1952	0	1	0	0	0	0	0	0	0	1	0	0	2
1953	1	2	0	1	0	0	0	0	0	1	0	1	6
1954	2	0	0	1	0	0	0	1	2	0	2	3	11
1955	1	1	0	0	0	0	0	0	0	0	1	2	5
1956	3	0	0	0	0	0	0	0	0	0	0	2	5
1957	6	2	0	0	0	0	0	0	1	0	1	0	10
1958	1	1	1	0	0	0	0	0	0	0	0	0	3
1959	2	2	0	0	0	0	0	0	0	2	0	0	6
1960	0	0	0	0	0	0	0	0	0	0	0	0	0
1961	1	1	2	0	0	0	0	0	1	1	0	1	7
1962	1	3	0	1	2	0	0	0	0	0	0	0	7
1963	0	0	1	0	0	0	0	0	2	1	0	1	5
1964	0	1	1	0	0	0	0	0	1	0	0	1	4
1965	1	1	0	0	0	0	0	0	0	0	1	0	3
1966	0	0	1	0	1	0	0	0	1	0	2	0	5
1967	0	1	0	2	0	0	0	0	0	2	0	1	6
1968	2	0	3	0	0	0	0	0	0	0	0	0	5
20 years mean	1.2	1.1	0.6	0.6	0.1	0.0	0.0	0.1	0.6	0.5	0.5	0.8	6.1

TABLE 5E

NUMBER OF DAYS AND HOURS WITH GUSTS OF 39 mph OR MORE AT
DYCE (ABERDEEN) AIRPORT
(10 YEARS FROM 1959 TO 1968)

<u>Year</u>		<u>Jan</u>	<u>Feb</u>	<u>Mar</u>	<u>Apr</u>	<u>May</u>	<u>Jun</u>	<u>Jul</u>	<u>Aug</u>	<u>Sep</u>	<u>Oct</u>	<u>Nov</u>	<u>Dec</u>	<u>Year Total</u>
1959	Days	8	6	1	2	1	3	2	3	0	5	7	12	50
	Hours	36	35	1	8	6	8	10	7	0	36	22	40	209
1960	Days	5	6	2	3	0	3	0	0	1	1	5	2	28
	Hours	26	27	2	26	0	12	0	0	1	4	8	3	109
1961	Days	4	5	8	0	0	2	2	1	4	11	2	2	41
	Hours	20	18	39	0	0	9	10	1	15	43	7	6	168
1962	Days	11	10	4	3	6	4	1	3	2	6	1	9	60
	Hours	34	60	12	18	57	15	6	17	7	24	3	20	273
1963	Days	0	1	4	1	5	0	0	1	3	7	3	7	32
	Hours	0	1	11	1	13	0	0	1	21	20	12	25	105
1964	Days	2	3	4	3	9	6	9	7	9	3	6	14	75
	Hours	5	17	29	6	40	18	38	24	35	8	17	48	285
1965	Days	10	4	5	6	3	3	2	4	7	5	12	2	63
	Hours	28	45	17	37	10	10	2	6	27	31	74	4	291
1966	Days	9	2	14	3	3	1	0	3	4	3	10	14	66
	Hours	29	6	79	18	19	3	0	13	21	11	76	70	345
1967	Days	12	12	24	10	7	4	2	1	3	10	6	14	105
	Hours	57	92	168	69	23	10	6	2	13	73	21	68	602
1968	Days	9	2	14	3	3	0	1	0	3	6	9	10	60
	Hours	50	14	80	15	12	0	2	0	12	32	34	49	300
10-year means	Days	7.0	5.1	8.0	3.4	3.7	2.6	1.9	2.3	3.6	5.7	6.1	8.6	58.0
	Hours	28.5	31.5	43.8	19.8	18.0	8.5	7.4	7.1	15.2	28.2	27.4	33.3	268.7

TABLE 5F

NUMBER OF DAYS AND HOURS WITH GUSTS OF 55 mph OR MORE AT
DYCE (ABERDEEN) AIRPORT
(10 YEARS FROM 1959 TO 1968)

<u>Year</u>		<u>Jan</u>	<u>Feb</u>	<u>Mar</u>	<u>Apr</u>	<u>May</u>	<u>Jun</u>	<u>Jul</u>	<u>Aug</u>	<u>Sep</u>	<u>Oct</u>	<u>Nov</u>	<u>Dec</u>	<u>Year Total</u>
1959	Days	1	2	0	0	0	0	0	0	0	2	0	0	5
	Hours	2	2	0	0	0	0	0	0	0	14	0	0	18
1960	Days	1	0	0	1	0	0	0	0	0	0	0	0	2
	Hours	2	0	0	1	0	0	0	0	0	0	0	0	3
1961	Days	1	1	2	0	0	0	0	0	1	2	0	1	8
	Hours	1	2	6	0	0	0	0	0	6	2	0	1	18
1962	Days	1	3	0	1	2	0	0	0	1	0	0	0	8
	Hours	1	20	0	2	3	0	0	0	1	0	0	0	27
1963	Days	0	0	1	0	0	0	0	0	0	0	0	1	2
	Hours	0	0	1	0	0	0	0	0	0	0	0	1	2
1964	Days	0	1	0	0	0	0	0	0	2	0	2	2	7
	Hours	0	2	0	0	0	0	0	0	3	0	2	2	9
1965	Days	1	2	0	0	0	0	0	0	0	1	2	0	6
	Hours	4	16	0	0	0	0	0	0	0	1	7	0	28
1966	Days	0	0	1	0	1	0	0	0	1	0	2	1	6
	Hours	0	0	2	0	8	0	0	0	6	0	14	2	32
1967	Days	0	6	8	3	0	1	0	0	0	3	0	3	24
	Hours	0	13	20	16	0	1	0	0	0	4	0	4	58
1968	Days	3	1	3	0	0	0	0	0	1	0	0	1	9
	Hours	6	1	8	0	0	0	0	0	1	0	0	1	17
10-year means	Days	0.8	1.6	1.5	0.5	0.3	0.1	0.0	0.0	0.6	0.8	0.6	0.9	7.7
	Hours	1.6	5.6	3.7	1.9	1.1	0.1	0.0	0.0	1.7	2.1	2.3	1.1	21.2

TABLE 5G

NUMBER OF DAYS ON WHICH THE HOURLY MEAN WIND SPEED REACHED 25 MPH OR MORE IN AT LEAST ONE HOUR BETWEEN 0700 HOURS AND 1700 HOURS GREENWICH MEAN TIME (8 AM AND 6 PM BRITISH STANDARD TIME)
AT DYCE (ABERDEEN) AIRPORT
(10 YEARS 1959 TO 1968)

<u>Year</u>	<u>Jan</u>	<u>Feb</u>	<u>Mar</u>	<u>Apr</u>	<u>May</u>	<u>Jun</u>	<u>Jul</u>	<u>Aug</u>	<u>Sep</u>	<u>Oct</u>	<u>Nov</u>	<u>Dec</u>	<u>Year Total</u>
<u>Number of Days</u>													
1959	4	8	1	2	1	1	1	1	0	3	3	5	30
1960	2	4	0	4	0	2	0	0	0	1	1	0	14
1961	2	5	4	0	0	1	2	0	3	6	2	2	27
1962	10	7	2	6	6	4	1	3	2	3	1	3	48
1963	0	1	3	2	5	0	1	1	2	5	3	4	27
1964	2	1	8	1	8	6	6	6	5	0	2	2	47
1965	5	3	2	3	4	3	0	3	4	4	4	1	36
1966	3	3	10	4	3	1	0	2	2	1	5	9	43
1967	4	8	21	10	5	3	2	1	1	7	3	7	72
1968	6	1	9	3	3	0	1	0	1	6	5	6	41
10-year mean	3.8	4.1	6.0	3.5	3.5	2.1	1.4	1.7	2.0	3.6	2.9	3.9	38.5

NUMBER OF HOURS BETWEEN 0700 HOURS AND 1700 HOURS GREENWICH MEAN TIME (8 AM AND 6 PM BRITISH STANDARD TIME) WITH HOURLY MEAN SPEEDS OF 25 MPH OR MORE AT DYCE (ABERDEEN) AIRPORT
(10 YEARS 1959 TO 1968)

<u>Year</u>	<u>Jan</u>	<u>Feb</u>	<u>Mar</u>	<u>Apr</u>	<u>May</u>	<u>Jun</u>	<u>Jul</u>	<u>Aug</u>	<u>Sep</u>	<u>Oct</u>	<u>Nov</u>	<u>Dec</u>	<u>Year Total</u>
<u>Number of Hours</u>													
1959	14	31	1	7	4	4	6	3	0	21	10	9	110
1960	16	17	0	19	0	9	0	0	0	1	1	0	63
1961	12	8	19	0	0	7	5	0	11	24	3	2	91
1962	17	28	9	25	35	13	8	11	3	8	1	7	165
1963	0	1	4	3	10	0	1	2	16	20	9	11	77
1964	7	10	63	1	26	9	34	18	17	0	5	3	193
1965	14	15	11	14	6	8	0	7	18	12	22	2	129
1966	15	6	44	13	16	6	0	9	11	2	37	34	193
1967	21	42	94	37	21	10	4	4	6	29	6	24	298
1968	19	10	49	10	14	0	5	0	1	24	20	17	169
10-year mean	13.5	16.8	29.4	12.9	13.2	6.6	6.3	5.4	8.3	14.1	11.4	10.9	148.8
10-year mean expressed as percentage of total working time	%	%	%	%	%	%	%	%	%	%	%	%	%
	4	6	9	4	4	2	2	2	3	5	4	4	4

TABLE 5H

TABLE FOR CONVERTING MILES PER HOUR TO METRES PER SECOND

(1 mile per hour = 0.44704 metres per second)

Miles per Hour	0	1	2	3	4	5	6	7	8	9
	Metres per Second									
0	0.0	0.4	0.9	1.3	1.8	2.2	2.7	3.1	3.6	4.0
10	4.5	4.9	5.4	5.8	6.3	6.7	7.2	7.6	8.0	8.5
20	8.9	9.4	9.8	10.3	10.7	11.2	11.6	12.1	12.5	13.0
30	13.4	13.9	14.3	14.8	15.2	15.6	16.1	16.5	17.0	17.4
40	17.9	18.3	18.8	19.2	19.7	20.1	20.6	21.0	21.5	21.9
50	22.4	22.8	23.2	23.7	24.1	24.6	25.0	25.5	25.9	26.4
60	26.8	27.3	27.7	28.2	28.6	29.1	29.5	30.0	30.4	30.8
70	31.3	31.7	32.2	32.6	33.1	33.5	34.0	34.4	34.9	35.3
80	35.8	36.2	36.7	37.1	37.6	38.0	38.4	38.9	39.3	39.8
90	40.2	40.7	41.1	41.6	42.0	42.5	42.9	43.4	43.8	44.3
100	44.7	45.2	45.6	46.0	46.5	46.9	47.4	47.8	48.3	48.7
110	49.2	49.6	50.1	50.5	51.0	51.4	51.9	52.3	52.8	53.2
120	53.6	54.1	54.5	55.0	55.4	55.9	56.3	56.8	57.2	57.7
130	58.1	58.6	59.0	59.5	59.9	60.4	60.8	61.2	61.7	62.1
140	62.6	63.0	63.5	63.9	64.4	64.8	65.3	65.7	66.2	66.6
150	67.1	67.5	68.0	68.4	68.8	69.3	69.7	70.2	70.6	71.1

6. FOG

The remoteness of Aberdeen from the industrial and populous areas of Great Britain and their smoke-soiled air means that Aberdeen has good visibility with a remarkably low frequency of thick and dense fogs.

The most frequent and perhaps the most unpleasant fogs which do occur in Aberdeen are not the smoke, radiation or sea fogs of winter but the haars (North Sea fogs) which occur from time to time during the period from April to September and which often ruin potentially brilliantly fine days. The basic cause of these haars is the moistening and cooling of warm air from the Continent by the cold waters of the North Sea, and haars are especially prevalent during the spring and early summer following a particularly cold winter when the sea temperature of the coastal waters is well below average.

The haar is normally fairly shallow. When it occurs at ground level in the lower parts of the Aberdeen area near the coast, the higher parts may be in sunshine above it. Frequently by the time the haar has reached the western suburbs, it has lifted into a layer of low stratus cloud, obscuring the sun and the higher ground and perhaps the higher buildings, but with reasonably good visibility beneath it. Where the haar reaches the ground, visibilities of less than 25 yards are not unknown. Occasionally, the haar may have sufficient depth to give rise to drizzle, particularly when it encounters rising ground. During daylight hours the sun's heat tends to "burn off" the haar. When the depth of the haar is not great it may disappear with dramatic suddenness leaving a cloudless sky but is likely to re-form again towards sunset. The deeper haars may persist all day, a frustrating situation which is not helped by the knowledge that places a few miles west or further inland are enjoying glorious sunshine.

The areas most prone to winter fogs are the lower-lying more densely built-up parts of the city and, in winter, visitors to Aberdeen from the rural areas of Aberdeenshire sometimes do not encounter fog until reaching the city itself.

The Variation of Poor Visibility with Wind Direction is shown in Table 6. It can

be seen from this Table that at Dyce Airport, in both summer and winter, fog or poor visibility is most frequent when winds are calm or from the sector between east-south-east and south and the same is no doubt true of the Aberdeen area as a whole. It should be noted, however, that light southeasterly winds at Dyce Airport will also bring smoke from the city.

At this point it should be explained that in the Meteorological Office, a fog is said to occur when the visibility falls to below 1,100 yards. A fog becomes "thick" when the visibility falls to less than 220 yards and "dense" when the visibility falls to below 55 yards.

Percentage Frequencies of Occurrence of Visibilities less than 1,100 yards, 220 yards and 55 yards according to month and certain hours of the day are given in Table 6A. Dyce Airport is the only location in the Aberdeen area for which basic records of visibility at different times of the day are available, but the relatively low frequency of fog from midday to late afternoon will be typical of the Aberdeen area as a whole.

The Number of Days and Hours with "Fog", "Thick Fog" and "Dense Fog" are given in Tables 6B and 6C. It can be seen from these Tables that fog in the Aberdeen area is more frequent in the spring and early summer than in winter. Indeed, perhaps it should be emphasised that the figures for the months of November to April include a very large number of days and hours when the visibility at Dyce Airport fell temporarily to below 1,100 yards, 220 yards or 55 yards because of falls of snow. The figures in Tables 6B and 6C were obtained from a search through the Dyce Registers of observations for the 10 years from 1957 to 1968. These Registers contain routine observations of visibility made at each hour on the hour, but notice was also taken of certain additional observations of fog made between the routine hourly observations. Thus, the number of "hours" with fog, thick fog and dense fog shown in Table 6C are really hours in which the visibility fell to below the stated limits for some time during the hour rather than an indication of the total duration of fog in hours. Similarly, in Table 6B, the number of "days" with fog are days on which the visibility fell to below the stated limits for some time during the day.

At Craibstone and Mannofield Reservoir, observations of visibility are made once-daily at 0900 hours GMT and the number of mornings with fog at these two locations are compared with similar observations made at Dyce Airport in Table 6D. The reader will note the higher frequency of fogs at Mannofield Reservoir although this is what one might expect in view of the fact that Mannofield Reservoir lies nearer to the sea than Craibstone and Dyce Airport and is also nearer to the main smoke producing areas of the city.

TABLE 6

PERCENTAGE DISTRIBUTION OF FOG AND POOR VISIBILITY ACCORDING TO WIND DIRECTION DURING THE WINTER AND SUMMER "HALF-YEARS" AT DYCE (ABERDEEN) AIRPORT - CALCULATED FROM OBSERVATIONS MADE 8 TIMES PER DAY AT 00, 03, 06, 09, 12, 15, 18 AND 21h GMT DURING THE 12 YEARS FROM 1957 TO 1968

Wind Direction Measured in Degrees from True North	Winter Half-Year (October to March)				Summer Half-Year (April to September)			
	Visibility less than 440 yards	Visibility 440 to 1,090 yards	Visibility 1,100 to 2,190 yards	Totals	Visibility less than 440 yards	Visibility 440 to 1,090 yards	Visibility 1,100 to 2,190 yards	Totals
(degrees)	%	%	%	%	%	%	%	%
350 to 010	0.2	1.0	2.3	3.5	0.8	0.7	1.5	3.0
020 to 040	0.0	0.4	0.6	1.0	0.7	0.6	1.4	2.7
050 to 070	0.5	0.4	0.7	1.6	1.2	0.9	2.8	4.9
080 to 100	0.9	0.7	3.3	4.9	3.4	3.4	3.6	10.4
110 to 130	2.3	3.3	6.3	11.9	4.9	4.8	7.8	17.5
140 to 160	3.6	3.6	9.7	16.9	2.3	3.7	7.6	13.6
170 to 190	0.7	1.2	8.1	10.0	0.5	1.5	3.5	5.5
200 to 220	0.1	0.0	0.5	0.6	0.0	0.1	0.3	0.4
230 to 250	0.0	0.0	0.0	0.0	0.2	0.1	0.1	0.4
260 to 280	0.2	0.1	0.4	0.7	0.3	0.2	0.1	0.6
290 to 310	0.2	1.4	1.9	3.5	0.3	0.4	0.1	0.8
320 to 340	0.6	1.7	2.8	5.1	0.3	0.4	1.8	2.5
Calms	12.2	10.7	17.4	40.3	16.0	11.2	10.5	37.7
Totals	21.5	24.5	54.0	100.0	30.9	28.0	41.1	100.0

Example

Out of the total number of 3-hourly observations of fog or poor visibility during the winter "half-years" in the 12 years from 1957 to 1968, 3.6 per cent of the total observations had visibilities of less than 440 yards associated with winds from the sector between 140 and 160 degrees.

TABLE 6A

PERCENTAGE FREQUENCY OF OCCURRENCE OF VISIBILITIES LESS THAN 1,100 YARDS,
220 YARDS AND 55 YARDS AT 0000, 0300, 0600, 0900, 1200, 1500, 1800
AND 2100 HOURS GMT - CALCULATED FROM VISIBILITIES OBSERVED
AT THESE 3-HOURLY INTERVALS DURING THE 12 YEARS FROM
1957 TO 1968 AT DYCE (ABERDEEN) AIRPORT

Time of Observation GMT	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Year
<u>Percentage Frequency of Occurrence of Visibilities less than 1,100 yards</u>													
	%	%	%	%	%	%	%	%	%	%	%	%	%
00h midnight	1.9	3.8	4.3	5.0	7.2	7.4	3.7	5.6	4.4	4.0	2.7	1.9	4.3
03h	2.2	3.8	3.2	7.5	12.1	11.9	4.6	8.1	5.5	4.8	3.0	0.3	5.6
06h	1.4	4.7	3.5	5.6	9.4	7.8	3.2	5.3	6.3	4.6	1.6	1.3	4.6
09h	3.5	3.8	3.0	2.2	3.2	1.9	1.6	1.3	0.8	1.9	1.6	1.6	2.2
12h noon	2.2	2.6	0.3	0.8	1.9	1.1	1.1	0.8	0.8	0.5	0.6	1.1	1.1
15h	1.6	1.8	1.1	0.8	1.3	1.4	0.8	0.3	1.1	0.8	1.1	0.5	1.0
18h	1.6	3.8	0.5	1.7	1.6	1.7	1.9	1.1	1.4	1.6	0.5	2.1	1.6
21h	1.6	1.8	2.9	3.3	5.6	4.1	1.9	2.7	3.6	3.2	2.2	1.8	2.9
<u>Percentage Frequency of Occurrence of Visibilities less than 220 yards</u>													
	%	%	%	%	%	%	%	%	%	%	%	%	%
00h midnight	0.0	0.3	1.1	1.7	2.4	1.9	0.5	1.3	1.1	1.3	0.5	0.3	1.0
03h	0.3	0.9	0.0	1.4	4.0	3.8	0.0	1.1	2.2	1.3	0.8	0.0	1.3
06h	0.3	0.9	0.8	2.0	1.3	1.4	0.3	0.5	1.9	0.6	0.5	0.5	0.9
09h	0.8	0.9	0.3	0.0	0.0	0.0	0.0	0.0	0.0	0.3	0.8	0.0	0.3
12h noon	0.6	0.3	0.0	0.3	0.0	0.0	0.0	0.0	0.3	0.5	0.3	0.3	0.2
15h	0.3	0.0	0.0	0.0	0.0	0.3	0.0	0.0	0.3	0.0	0.0	0.0	0.1
18h	0.3	0.3	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.8	0.0	0.5	0.2
21h	0.0	0.3	0.8	0.8	1.6	0.8	0.0	0.8	0.5	0.8	0.3	0.5	0.6
<u>Percentage Frequency of Occurrence of Visibilities less than 55 yards</u>													
	%	%	%	%	%	%	%	%	%	%	%	%	%
00h midnight	0.0	0.0	0.3	0.0	0.8	0.5	0.0	0.0	0.0	0.0	0.0	0.0	0.1
03h	0.0	0.0	0.0	0.3	0.0	0.5	0.0	0.0	0.0	0.0	0.0	0.0	0.1
06h	0.0	0.0	0.0	0.3	0.0	0.3	0.0	0.0	0.0	0.1	0.0	0.0	0.1
09h	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
12h noon	0.3	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0+
15h	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
18h	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
21h	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.3	0.0	0.0	0.0+

Example In January, visibility at 1200 hours GMT (noon) was less than 1,100 yards on 2.2 per cent of occasions during the 12 years from 1957 to 1968.

TABLE 6B

NUMBER OF DAYS WITH "FOG", "THICK FOG" AND "DENSE FOG" AT ANY TIME OF DAY*
AT DYCE (ABERDEEN) AIRPORT
(10 YEARS FROM 1959 TO 1968)

Year	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Year Total
<u>Number of Days with "Fog" - Visibility less than 1,100 yards</u>													
1959	13	3	5	3	6	6	3	5	10	7	2	6	69
1960	6	12	7	4	8	4	7	8	6	6	6	2	76
1961	3	5	1	11	4	3	2	3	2	5	2	12	53
1962	4	8	8	5	7	0	4	3	3	2	5	6	55
1963	7	6	5	8	4	10	4	3	1	3	7	5	63
1964	3	9	5	8	11	6	5	6	5	7	3	6	74
1965	8	4	5	5	10	9	10	3	6	8	4	4	76
1966	8	8	6	2	7	14	0	6	4	6	0	4	65
1967	6	1	2	2	7	8	0	4	10	0	2	7	49
1968	8	2	3	16	6	9	4	9	9	8	0	6	80
10-year mean	6.6	5.8	4.7	6.4	7.0	6.9	3.9	5.0	5.6	5.2	3.1	5.8	66.0
<u>Number of Days with "Thick Fog" - Visibility less than 220 yards</u>													
1959	4	1	0	1	3	3	1	3	4	3	0	3	26
1960	2	3	2	1	6	2	1	3	2	1	1	1	25
1961	0	2	0	4	3	0	0	0	1	3	0	3	16
1962	0	5	2	3	3	0	0	0	1	0	1	2	17
1963	0	0	2	3	2	5	0	0	0	2	2	1	17
1964	2	4	0	4	8	3	1	0	3	3	1	0	29
1965	2	0	1	2	4	2	2	1	2	4	1	0	21
1966	3	3	0	0	3	5	0	2	0	4	0	0	20
1967	0	0	0	1	0	1	0	0	3	0	0	1	6
1968	1	0	1	6	3	2	0	2	3	1	0	0	19
10-year mean	1.4	1.8	0.8	2.5	3.5	2.3	0.5	1.1	1.9	2.1	0.6	1.1	19.6
<u>Number of Days with "Dense Fog" - Visibility less than 55 yards</u>													
1959	0	0	0	0	0	0	0	1	1	0	0	0	2
1960	0	0	0	0	0	0	0	0	0	0	0	0	0
1961	0	0	0	0	0	0	0	0	0	0	0	0	0
1962	0	0	0	0	0	0	0	0	0	0	0	0	0
1963	0	0	0	0	0	1	0	0	0	1	0	0	2
1964	0	0	0	0	1	0	0	0	0	0	0	0	1
1965	0	0	0	1	2	0	0	0	0	0	0	0	3
1966	0	0	0	0	0	1	0	1	0	0	0	0	2
1967	0	0	0	0	0	0	0	0	1	0	0	0	1
1968	0	0	0	1	1	1	0	0	0	1	0	0	4
10-year mean	0.0	0.0	0.0	0.2	0.4	0.3	0.0	0.2	0.2	0.2	0.0	0.0	1.5

*Calculated mainly from hourly observations of visibility made at each hour on the hour.

TABLE 6C

NUMBER OF HOURS* WITH "FOG", "THICK FOG" AND "DENSE FOG"
AT DYCE (ABERDEEN) AIRPORT
(10 YEARS FROM 1959 TO 1968)

Year	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Year Total
<u>Number of Hours with "Fog" - Visibility less than 1,100 yards</u>													
1959	39	27	29	8	34	40	10	29	26	30	6	20	298
1960	24	45	34	11	39	14	29	27	23	14	15	11	286
1961	4	13	2	56	15	5	17	4	4	28	4	42	194
1962	6	30	32	15	24	0	35	8	17	11	24	14	216
1963	10	10	23	33	19	73	17	7	1	13	40	15	261
1964	16	78	14	52	101	20	24	27	24	28	10	12	406
1965	32	6	21	38	80	52	43	12	22	45	15	7	373
1966	27	45	13	5	30	94	0	26	14	36	0	5	295
1967	10	1	2	7	25	24	0	20	41	0	9	17	156
1968	23	15	16	95	46	22	8	50	52	31	0	16	374
10-year mean	19.1	27.0	18.6	32.0	41.3	34.4	18.3	21.0	22.4	23.6	12.3	15.9	285.9
<u>Number of Hours with "Thick Fog" - Visibility less than 220 yards</u>													
1959	8	5	0	1	10	9	1	11	5	12	0	4	66
1960	5	6	3	3	9	3	2	11	2	4	3	2	53
1961	0	4	0	9	4	0	0	0	1	5	0	10	33
1962	0	10	5	6	10	0	0	0	6	0	2	4	43
1963	0	0	2	11	5	18	0	0	0	8	9	1	54
1964	6	15	0	14	23	6	4	0	14	8	3	0	93
1965	2	0	2	12	24	6	4	1	4	15	3	0	73
1966	8	15	0	0	7	24	0	5	0	12	0	0	71
1967	0	0	0	1	0	2	0	0	5	0	0	1	9
1968	1	0	1	17	13	5	0	4	11	2	0	0	54
10-year mean	3.0	5.5	1.3	7.4	10.5	7.3	1.1	3.2	4.8	6.6	2.0	2.2	54.9
<u>Number of Hours with "Dense Fog" - Visibility less than 55 yards</u>													
1959	0	0	0	0	0	0	0	1	1	0	0	0	2
1960	0	0	0	0	0	0	0	0	0	0	0	0	0
1961	0	0	0	0	0	0	0	0	0	0	0	0	0
1962	0	0	0	0	0	0	0	0	0	0	0	0	0
1963	0	0	0	0	0	2	0	0	0	3	0	0	5
1964	0	0	0	0	1	0	0	0	0	0	0	0	1
1965	0	0	0	1	5	0	0	0	0	0	0	0	6
1966	0	0	0	0	0	3	0	1	0	0	0	0	4
1967	0	0	0	0	0	0	0	0	1	0	0	0	1
1968	0	0	0	1	1	1	0	0	0	1	0	0	4
10-year mean	0.0	0.0	0.0	0.2	0.7	0.6	0.0	0.2	0.2	0.4	0.0	0.0	2.3

*Calculated mainly from hourly observations of visibility made at each hour on the hour.

TABLE 6D

NUMBER OF MORNINGS WITH FOG (VISIBILITY LESS THAN 1,100 YARDS) AT
0900 HOURS GMT AT STATIONS IN THE ABERDEEN AREA
(10 years 1959 to 1968)

Year	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Year Total
<u>DYCE AIRPORT</u>													
1959	0	2	2	0	0	0	0	0	0	1	0	3	8
1960	2	1	2	0	1	0	0	0	0	0	0	0	6
1961	0	1	0	2	0	0	1	0	0	1	0	1	6
1962	0	0	1	0	1	0	0	0	1	0	1	0	4
1963	0	0	1	2	0	2	0	0	0	0	2	1	8
1964	1	4	0	1	3	0	1	1	0	1	0	0	12
1965	3	0	1	1	2	1	0	0	0	1	1	0	10
1966	4	3	0	0	1	4	0	0	0	1	0	0	13
1967	0	0	0	0	1	0	0	1	1	0	0	0	3
1968	0	1	1	1	2	0	0	1	0	2	0	1	9
10-year mean	1.0	1.2	0.8	0.7	1.1	0.7	0.2	0.3	0.2	0.7	0.4	0.6	7.9
<u>CRAIBSTONE</u>													
1959	0	1	3	0	0	2	2	0	0	0	0	0	8
1960	0	0	2	0	1	0	1	0	0	0	0	0	4
1961	0	0	0	3	0	0	1	0	0	2	0	1	7
1962	0	0	0	0	1	0	0	0	1	1	2	0	5
1963	0	0	1	1	0	3	0	0	0	0	4	0	9
1964	0	3	1	1	2	0	1	2	0	0	0	0	10
1965	0	0	1	2	3	1	1	0	0	2	1	0	11
1966	2	1	0	1	1	5	0	1	0	1	0	0	12
1967	1	0	0	0	2	0	0	1	2	0	0	0	6
1968	0	0	0	2	1	0	0	2	1	1	1	0	8
10-year mean	0.3	0.5	0.8	1.0	1.1	1.1	0.6	0.6	0.4	0.7	0.8	0.1	8.0
<u>MANNOFIELD RESERVOIR</u>													
1959	1	7	5	1	0	2	2	1	1	0	0	0	20
1960	1	2	4	0	0	0	0	1	1	1	0	0	10
1961	0	1	0	2	0	0	1	0	0	0	0	2	6
1962	0	0	0	2	1	0	0	0	1	0	0	0	4
1963	0	0	1	3	0	2	0	0	0	2	3	0	11
1964	0	5	0	3	1	0	1	2	1	1	0	0	14
1965	0	0	1	2	3	1	1	1	0	4	1	0	14
1966	1	2	1	1	1	9	0	0	1	1	0	0	17
1967	0	0	0	0	2	0	0	1	2	0	1	0	6
1968	0	1	0	2	3	0	0	3	2	1	0	0	12
10-year mean	0.3	1.8	1.2	1.6	1.1	1.4	0.5	0.9	0.9	1.0	0.5	0.2	11.4

7. SNOW

In Aberdeen, as elsewhere in the British Isles, the incidence of snow falling and the persistence of snow cover are two of the most variable of all the meteorological elements. For example, during the winter of 1962/63, there were 63 mornings with snow lying on the ground at Dyce Airport compared with only 12 mornings during the following winter of 1963/64.

At Dyce Airport, there are, on average, about 47 days per year with snow or sleet falling. Most of the days with snowfall occur in December, January, February and March but snow can fall in the Aberdeen area as late as May or as early as October although snow falling in May or October seldom lies on the ground for any length of time. Sleet fell at Dyce Airport on 29 September 1954, but sleet or snow in September is a very rare occurrence.

Up to heights of about 200 feet above sea level, there is not much variation from place to place in the incidence of snowfall and therefore the Dyce Airport figures of the number of days of snow or sleet falling can be taken as being reasonably representative of most of Aberdeen and its immediate surroundings. The Meteorological Office at Dyce Airport is the only weather station in the Aberdeen area keeping a 24 hour watch on the weather, and is therefore the only weather station for which complete records of snow falling at any time of the day or night are available. However, the number of days with snow falling increases fairly rapidly with increasing height above sea level, and as a good approximate rule, there is one more day per year with snow falling for each 50 feet of elevation above 200 feet up to an altitude of about 1,000 feet.

Whether snow will lie, after it has fallen, in sufficient depth to cause difficulty to transport, depends on a number of complex factors, but a greater height above sea level and a north or east-facing aspect of the surface will certainly increase the number of days with snow lying. As the general lie of the ground in the Aberdeen area is on an east-facing slope, the persistence of snow cover can be a nuisance particularly in the higher districts.

During a severe winter with snow lying on the ground, the partial thaws during the daytime do little to clear the roads at higher levels in the city and its

outskirts where the snow becomes compacted and even more treacherous to road users, especially at night time when the compacted snow or wet parts of the road have an icy surface. There is the further point that the daily expansion and contraction caused by the freezing and thawing processes coupled with the scrapings of snow-ploughs cause damage to road surfaces which often need extensive repairs after a severe winter. Partly because of its ability to penetrate into the snow, rain is a good thawing agent, but it should be remembered that precipitation falling at temperatures up to about 36 degrees Fahrenheit will almost certainly be in the form of snow.

The Aberdeen area is very open to the sector between north-west and north-east and it is hardly surprising that the greatest risk of heavy snowfalls occurs when northerly winds bring polar air into the region. These heavy snowfalls are sometimes accompanied by strong northerly winds and therefore even relatively light falls of snow can lead to severe drifting in the areas of Aberdeen lacking local shelter. Although very infrequent, there have been occasions following an influx of polar air when heavy falls of snow accompanied by high winds have resulted in a disruption of communications with the city being virtually isolated because of roads blocked by snow and stationary traffic; a recent example occurred in the period from 7 to 9 February 1969.

The Actual and Average Numbers of Days with Snow or Sleet Falling are given in Table 7.

The Actual and Average Numbers of Days with Snow lying are given in Tables 7A and 7B.

The Number of Days per Winter with Snow lying at Specified Depths are given in Table 7C.

Water Yield from Snow

At the present time there is a distinct lack of suitable long term records providing the actual water equivalents of sample depths of melted snow. However, as one would expect, the available evidence indicates that the water yield from "wet" snow falling in temperatures above freezing point is considerably higher than the water yield from an equivalent depth of "dry" snow falling in temperatures

below freezing point. In fact there is a steady increase with increasing temperature in the water yield per inch of snow and a sharp increase around freezing point (10).

The most commonly occurring water yield from samples of melted snow is one inch of water from about 12 inches of snow and until further evidence becomes available, it is suggested that this value be used for general planning purposes. However, perhaps it should be emphasised that the suggested yield of one inch of water from 12 inches of snow can only be taken as a very approximate guide because one inch of water has been obtained by melting depths of snow considerably more and considerably less than 12 inches.

TABLE 7

ACTUAL AND AVERAGE NUMBER OF DAYS WITH SNOW OR SLEET FALLING
AT DYCE (ABERDEEN) AIRPORT
(23 YEARS FROM 1946 TO 1968)

<u>Year</u>	<u>Jan</u>	<u>Feb</u>	<u>Mar</u>	<u>Apr</u>	<u>May</u>	<u>Jun</u>	<u>Jul</u>	<u>Aug</u>	<u>Sep</u>	<u>Oct</u>	<u>Nov</u>	<u>Dec</u>	<u>Year Total</u>
1946	5	10	9	1	3	0	0	0	0	0	1	1	30
1947	11	18	11	3	1	0	0	0	0	0	9	5	58
1948	9	3	0	2	2	0	0	0	0	2	2	2	22
1949	7	4	12	3	1	0	0	0	0	1	0	5	33
1950	5	10	3	5	0	0	0	0	0	1	3	16	43
1951	8	10	14	10	2	0	0	0	0	2	3	5	54
1952	19	12	7	2	0	0	0	0	0	0	4	9	53
1953	4	11	2	5	0	0	0	0	0	0	0	1	23
1954	11	11	5	2	1	0	0	0	1	1	1	7	40
1955	15	19	14	1	10	0	0	0	0	6	0	11	76
1956	17	17	8	8	0	0	0	0	0	2	3	7	62
1957	6	10	1	4	3	0	0	0	0	0	0	8	32
1958	15	15	18	6	1	0	0	0	0	0	0	5	60
1959	19	3	0	2	0	0	0	0	0	1	0	1	26
1960	13	14	3	1	0	0	0	0	0	0	0	3	34
1961	14	3	6	3	2	0	0	0	0	0	2	15	45
1962	2	13	15	6	1	0	0	0	0	2	7	9	55
1963	22	20	0	2	0	0	0	0	0	0	4	9	57
1964	1	5	7	0	0	0	0	0	0	2	0	9	24
1965	17	10	13	3	2	0	0	0	0	0	17	13	75
1966	11	12	10	11	0	0	0	0	0	0	6	14	64
1967	10	3	9	6	3	0	0	0	0	2	3	15	51
1968	15	12	7	7	2	0	0	0	0	1	8	14	66
23-year average	11	11	8	4	1	0	0	0	< 1	1	3	8	47

TABLE 7A

ACTUAL AND AVERAGE NUMBER OF DAYS WITH SNOW LYING ON THE GROUND
AT 0900 HOURS GMT AT DYCE (ABERDEEN) AIRPORT
(23 YEARS FROM 1946 TO 1968)

<u>Year</u>	<u>Jan</u>	<u>Feb</u>	<u>Mar</u>	<u>Apr</u>	<u>May</u>	<u>Jun</u>	<u>Jul</u>	<u>Aug</u>	<u>Sep</u>	<u>Oct</u>	<u>Nov</u>	<u>Dec</u>	<u>Year Total</u>
1946	6	7	9										22
1947	3	28	26								8	7	72
1948	5												5
1949	1	1	5									3	10
1950	3	5	1								1	17	27
1951	2	3	6									5	16
1952	10	11	2	1							8	5	37
1953	2	9											11
1954	4	5	6	0	1							3	19
1955	11	19	12									9	51
1956	12	19	3	2							1	0	37
1957	1											2	3
1958	14	12	15										41
1959	23												23
1960	7	15	1										23
1961	1	2	2									10	15
1962	8	4	13								8	7	40
1963	27	21										8	56
1964	0	3	1									6	10
1965	13	3	10								11	5	42
1966	10	11	4								2	2	29
1967	8	1	1	0	1							10	21
1968	13	8	0	4								5	30
23-year average	8	8	5	< 1	< 1	0	0	0	0	0	2	5	28

Note: A "day with snow-lying" is counted when half or more of the ground surrounding the weather station is covered with snow at 0900 hours GMT.

TABLE 7B

AVERAGE NUMBER OF DAYS WITH SNOW LYING ON THE GROUND AT 0900 HOURS GMT (10 AM
BRITISH STANDARD TIME) AT LOCATIONS IN THE ABERDEEN AREA

	<u>Jan</u>	<u>Feb</u>	<u>Mar</u>	<u>Apr</u>	<u>May</u>	<u>Jun</u>	<u>Jul</u>	<u>Aug</u>	<u>Sep</u>	<u>Oct</u>	<u>Nov</u>	<u>Dec</u>	<u>Year Total</u>
	<u>Average Number of Days</u>												

DYCE AIRPORT (altitude 190 feet) - 20 years from 1949 to 1968

	9	8	4	1	1	0	0	0	0	0	2	5	28
--	---	---	---	---	---	---	---	---	---	---	---	---	----

CRAIBSTONE (altitude 300 feet) - 20 years from 1949 to 1968

	11	10	6	1	1	0	0	0	0	1	2	6	36
--	----	----	---	---	---	---	---	---	---	---	---	---	----

MANNOFIELD RESERVOIR (altitude 171 feet) - 20 years from 1949 to 1968

	7	7	3	1	0	0	0	0	0	0	1	4	22
--	---	---	---	---	---	---	---	---	---	---	---	---	----

MUCHALLS (altitude 210 feet) - 15 years from 1951 to 1965

	6	6	3	0	0	0	0	0	0	0	2	3	20
--	---	---	---	---	---	---	---	---	---	---	---	---	----

Note: A 'day with snow lying' is counted when half or more of the ground surrounding the weather station is covered with snow at 0900 hours GMT.

TABLE 7C

NUMBER OF DAYS WITH SNOW LYING AT 0900 HOURS GREENWICH MEAN TIME
AT DEPTHS BETWEEN SPECIFIED LIMITS AT PLACES IN THE ABERDEEN AREA

DYCE AIRPORT - Altitude 190 feet						Maximum Depth = 20 inches			
Depth - Inches	0-1	2	3-4	5-6	7-8	9-12	13-16	Over 16	Total
Winter of:									
1953-54	5	5	5						15
1954-55	7	11	6	9	2	7	1	2	45
1955-56	19	10	10	6					45
1956-57	2								2
1957-58	16	5	6	5	8	3			43
1958-59	8	2	6	5	2				23
1959-60	4	5	8	2	3	1			23
1960-61	4	1							5
1961-62	9	10	7	2	2	3	2		35
1962-63	16	18	20	9					63
1963-64	6	2	4						12
1964-65	9	11	9	3					32
1965-66	32	6	3						41
1966-67	13	2							15
1967-68	17	6	9	1	1	1			35
1968-69	10	7	3	6	3	5			34
Total	177	101	96	48	21	20	3	2	468
% Total	38	22	21	10	4	4	1	< 1	100%

CRAIBSTONE - Altitude 300 feet						Maximum Depth = 18 inches			
Depth - Inches	0-1	2	3-4	5-6	7-8	9-12	13-16	Over 16	Total
Winter of:									
1946-47	5	2	7	10	6	15	10	5	60
1947-48	28	1	2						31
1948-49	16								16
1949-50	15	2	1						18
1950-51	33	2	6	2					43
1951-52	21	10	11						42
1952-53	10		11	3					24
1953-54	15	1	2	6					24
1954-55	23	9	5	7	3	4	3	4	58
1955-56	39	8	5	4	3				59
1956-57	8								8
1957-58	30	2	6	7	10	1			56
1958-59	8	6	7	2					23
1959-60	6	4	5	7	2				24
1960-61	9	2							11
1961-62	22	9	4	2	1	1	4		43
1962-63	19	12	39	9					79
1963-64	12	2	4						18
1964-65	18	9	12	2					41
1965-66	47	2	2	1					52
1966-67	19								19
1967-68	24	6	12	0	2	1			45
1968-69	14	4	7	4	5	6			40
Total	441	93	148	66	32	28	17	9	834
% Total	53	11	18	8	4	3	2	1	100%

TABLE 7C (Contd.)

MANNOFIELD RESERVOIR - Altitude 171 feet									Maximum Depth = 16 inches
Depth - Inches	0-1	2	3-4	5-6	7-8	9-12	13-16	Over 16	Total
Winter of:									
1956-57									0
1957-58	10	4	11	5					30
1958-59	8	13	1						22
1959-60	4	5	12						21
1960-61	3								3
1961-62	15	8	1	2	1	3	2		32
1962-63	33	4	8	1					46
1963-64	4	1	2	1					8
1964-65	19	8							27
1965-66	35	5	1						41
1966-67	13								13
1967-68	31	1	1	2	1				36
1968-69	11	6	2	6	3	5			33
Total	186	55	39	17	5	8	2		312
% Total	59	18	12	5	2	3	1		100%

MUCHALLS - Altitude 210 feet									Maximum Depth = 24 inches
Depth - Inches	0-1	2	3-4	5-6	7-8	9-12	13-16	Over 16	Total
Winter of:									
1956-57									0
1957-58	13	6	6	1					26
1958-59	6	6	3	1					16
1959-60	9	5	8						22
1960-61	2								2
1961-62	11	3	3	2	1	1	1	3	25
1962-63	29	8	9						46
1963-64	0	2	3						5
1964-65	21	3	3						27
Total	91	33	35	4	1	1	1	3	169
% Total	54	19	21	2	<1	<1	<1	2	100%

8. THUNDERSTORMS

In common with all the other major centres of population in Scotland, Aberdeen has a low incidence of thunderstorms and damaging hail. On the long term average, Aberdeen and Edinburgh have about 7 days per year with thunderstorms compared with 8 days in Glasgow, 14 days in Birmingham and 16 days in London. Thunderstorms can occur in Aberdeen during any month of the year but the frequency in winter, from October to April, is very low and thunderstorms occur most often in the months of May to September, but even in these months the long term average works out at only one day per month with a thunderstorm.

There are no systematic records of thunderstorms over the high ground to the west of Aberdeen, but it is thought that the frequency of thunderstorms over the high moorland areas and foothills of the Grampians is higher than in the Aberdeen area itself.

The Numbers of Days with Thunderstorms at Dyce (Aberdeen) Airport are given in Table 8.

TABLE 8

ACTUAL AND AVERAGE NUMBER OF DAYS WITH THUNDERSTORMS AT
DYCE (ABERDEEN) AIRPORT
(20 YEARS FROM 1949 TO 1968)

Year	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Year Total
1949	0	0	0	0	2	1	2	5	2	0	0	0	12
1950	0	0	0	0	0	1	3	2	1	0	1	0	8
1951	0	0	0	0	0	1	2	0	1	0	1	0	5
1952	0	0	0	0	2	0	1	5	0	1	0	0	9
1953	0	0	2	1	1	1	1	2	0	0	0	0	8
1954	0	0	0	0	2	1	1	1	2	2	1	1	11
1955	1	1	0	0	1	0	0	1	1	1	0	0	6
1956	0	0	0	0	0	0	1	0	0	0	0	1	2
1957	0	0	0	1	2	4	2	2	1	0	1	0	13
1958	1	0	0	0	4	0	2	2	2	0	0	0	11
1959	0	0	0	0	2	1	3	0	0	1	1	0	8
1960	0	0	0	0	1	2	2	2	1	0	0	0	8
1961	0	0	0	1	0	0	0	2	1	0	0	0	4
1962	0	1	0	0	2	0	3	1	0	0	0	0	7
1963	0	0	0	0	1	4	0	0	0	0	0	1	6
1964	0	0	0	0	0	1	1	1	0	0	0	0	3
1965	0	0	0	0	0	1	0	1	0	0	0	0	2
1966	0	0	0	1	0	2	1	0	1	0	0	1	6
1967	0	0	1	0	2	1	1	1	0	0	0	0	6
1968	0	0	0	0	0	2	2	2	0	0	0	0	6
20-year mean	0.1	0.1	0.1	0.2	1.1	1.1	1.4	1.5	0.7	0.3	0.3	0.2	7.1

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NOTES